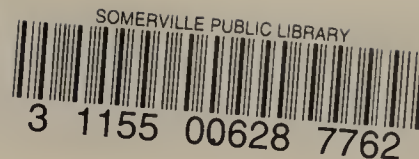


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Geotechnical  
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DEP  
NORTHEAST REGIONAL OFFICE

DEP RTNs 3-23246, 3-24358, and 3-24376

## IRA Status Report No. 1

50 Tufts Street, Somerville, MA

Submitted to:  
UniFirst Corporation  
68 Jonspin Road  
Wilmington, MA 01887

Submitted by:  
GEI Consultants, Inc.  
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May 8, 2006

Project 04516

REF  
354  
353  
GEI

Helen S. Gladstone, P.E., LSP  
Vice President



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- A. Copy of IRA Status Report Transmittal Form (BWSC105)
- B. Copies of City of Somerville and GEI Letters, and Neighborhood Meeting (March 14, 2006) Sign-In Form
- C. Air Sampling Work Plan
- D. Air Sampling Quality Assurance Project Plan (QAPP)

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## Executive Summary

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On behalf of its client, UniFirst Corporation (UniFirst), GEI Consultants, Inc. (GEI) prepared this Immediate Response Action (IRA) Status Report No. 1 to summarize activities performed between January 9 and April 14, 2006, for the Site located at 50 Tufts Street in Somerville, Massachusetts. Based on the results of assessments conducted to date, the Site includes the 50 Tufts Street property (the Property), together with portions of properties located across that public street to the east of the Property. Further assessments will be undertaken as part of IRA and Phase II investigations to delineate the Site boundaries. The IRA Plan was submitted to the Massachusetts Department of Environmental Protection (DEP) on January 9, 2006.

Chlorinated volatile organic compounds (VOCs) were detected in soil and groundwater samples collected from the Site. Chlorinated VOCs were also detected in indoor air samples collected from residences along Tufts Street and in air samples collected in the building at the Property. DEP assigned Release Tracking Numbers (RTNs) 3-23246, 3-24358, 3-24376 to these identified releases.

A Notice of Responsibility (NOR) was issued to UniFirst on November 9, 2006, which required an IRA. The IRA activities performed by UniFirst to date include:

- Evaluating whether or not an Imminent Hazard exists at the Property. An Imminent Hazard does not currently exist at the Property based on the Imminent Hazard Evaluation that was submitted to DEP on January 9, 2006.
- Conducting indoor air monitoring at residences along Tufts Street. Following a neighborhood meeting with the residents along Tufts Street and with City officials, we conducted the first round of indoor air sampling proposed in the IRA Plan. The indoor air sampling was conducted at 9, 11, 13, 17, 23, and 27 Tufts Street on March 23 and 24, 2006. The testing results will be provided to DEP in an Interim IRA Status Report once the data have been validated.
- Initiating the evaluation of the extent of the shallow groundwater plume. GEI prepared and submitted permit applications to the City of Somerville requesting permission to install borings and monitoring wells in the roadways in the vicinity of the Property. We anticipate approval of the permits and conducting these subsurface investigations in April and May 2006.



# 1. Introduction

---

On behalf of UniFirst Corporation, GEI Consultants, Inc. (GEI) prepared this Immediate Response Action (IRA) Status Report No. 1 to summarize activities performed between January 9 and April 14, 2006, for the Site located at 50 Tufts Street in Somerville, Massachusetts. Based on the results of assessments conducted to date, the Site includes the 50 Tufts Street property (the Property), together with portions properties located across that public street to the east of the Property. Further assessments will be undertaken as part of the IRA and Phase II investigations to delineate the Site boundaries.

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## 1.1 Purpose

The Site is listed with the DEP due to the release of chlorinated volatile organic compounds (VOCs) at the Property. The purpose of the IRA is to conduct soil, groundwater, and air sampling and testing to evaluate the presence of chlorinated VOCs on and in the vicinity of the Property. The IRA Plan was submitted to the Massachusetts Department of Environmental Protection (DEP) on January 9, 2006, associated with Release Tracking Numbers (RTNs) 3-23246, 3-24358, and 3-24376.

This IRA Status Report summarizes activities conducted from January 9 through April 14, 2006. This IRA Status Report fulfills the requirements of the MCP (310 CMR 40.0425).

## 1.2 Objective

The objectives of the IRA are to:

- Evaluate whether or not an Imminent Hazard exists at the Property.
- Conduct quarterly indoor air monitoring at 17 and 19 Tufts Street, at which remedial work previously has been conducted.



- Conduct indoor air monitoring at additional residences along Tufts Street.
- Evaluate the extent of the shallow groundwater plume.
- Evaluate subsurface utilities as a potential migration pathway.
- Evaluate the potential for impact to additional receptors.

### **1.3 IRA Activities**

The IRA activities conducted from January 9 through April 14, 2006, included:

- Evaluating whether an Imminent Hazard exists at the Property. – An LSP opinion concluding that the Property is currently not occupied and that based on the current use, an Imminent Hazard does not exist, was submitted to DEP on January 9, 2006.
- Conducting indoor air sampling at the residences along Tufts Street. The validated testing results were not available at the time of this submittal and an Interim IRA Status Report will be provided once the data have been validated.
- Initiating the evaluation of the shallow groundwater plume in the vicinity of the Property.

### **1.4 Submittals**

The original IRA Transmittal Form (BWSC105) is attached and a copy is in Appendix A.



## 2. Background

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Three DEP RTNs are assigned to the Site: 3-23246, 3-24358, and 3-24376.

### 2.1 Release Reporting

#### 2.1.1 Release Tracking Number (RTN) 3-23246

In 2002, Mr. Francis Margaglione, a prospective purchaser of the Property engaged Sanborn, Head & Associates (SHA) of Westford, Massachusetts, to conduct an environmental due diligence investigation. SHA performed a subsurface exploration program collecting soil and groundwater samples for laboratory analyses. SHA measured perchloroethylene (PCE), trichloroethylene (TCE) and other chlorinated VOCs in soil and groundwater samples in concentrations greater than the applicable Massachusetts Contingency Plan (MCP) reportable concentrations for soil (RCS1) and groundwater (RCGW2).

Mr. Margaglione provided the data to 50 Tufts Street, Inc., the Property owner. On October 3, 2003, on behalf of 50 Tufts Street, Inc., Mr. Craig Campbell notified DEP of a release of PCE and other hazardous materials in excess of the applicable reportable concentrations. DEP issued an NOR to 50 Tufts Street, Inc. and assigned RTN 3-23246 to the release.

#### 2.1.2 Release Tracking Number 3-24376

In August 2004, on behalf of Atlantic National Trust, LLC (holder of a mortgage on the Property), GeoInsight Inc. of Westford, Massachusetts installed four groundwater monitoring wells along the east side of Tufts Street, approximately 30 to 40 feet from the Property. PCE, TCE, and 1,1,1-trichloroethane (1,1,1-TCA) were detected in groundwater collected from each of the wells. In two of the wells located within 30 feet of residences, the concentrations of total VOCs were greater than 5 milligrams per liter (mg/L), triggering an MCP 72-hour reporting requirement.

On November 5, 2004, DEP issued an NOR to 50 Tufts Street, Inc. to conduct an IRA to evaluate the potential for a Critical Exposure Pathway (CEP) and/or a condition of Substantial Release Migration (SRM) due to the presence of VOCs in concentrations greater than 5 mg/L in the groundwater within 30 feet of occupied residences. DEP assigned RTN 3-24376 to the release.



### **2.1.3 Release Tracking Number 3-24358**

Based on a recommendation by SHA, on September 23, 2004, on behalf of the building tenant, Father & Son Moving & Storage, SHA collected a sample of indoor air from the office portion of the building at the Property and submitted the sample for laboratory analysis of VOCs. PCE (929 parts-per-billion-volume [ppbv]), TCE (43.5 ppbv) and related chlorinated VOCs were detected at elevated concentrations in the air sample. Based on the air testing results, SHA concluded there was a potential for an Imminent Hazard to a 40-hour per week commercial worker when evaluated over a period of five years.

On behalf of the building tenant, SHA reported the Imminent Hazard to DEP on October 22, 2004. SHA identified the John Danais Company as the owner of the Property. DEP assigned RTN 3-24358 to the release. On November 16, 2004, DEP issued an NOR to the John Danais Company.

## **2.2 Site Description**

The Site is located along Tufts Street in Somerville, Massachusetts (Fig. 1), with Universal Transverse Mercator (UTM) coordinates of 4,694,322 N and 328,049 E.

The Property is zoned for business. It is approximately 51,111 square feet (sf) and developed with an approximately 20,594 sf one-story masonry block building (Fig. 2). The majority of the building is warehouse space and a small portion is office space. There are varying ceiling heights and clearance throughout the building, and the floor level of approximately one-third of the building is approximately four feet below that of the remainder of the building.

The eastern side of the building abuts the sidewalk and then Tufts Street and the western side of the building is a narrow strip of vegetation and then railroad tracks. Immediately north and south of the building is paved parking. Further south of the building, a grassed hill slopes down to Washington Street. The Property is fenced with a 6-foot-high chain-link fence near the building.

In a memorandum dated August 7, 2002, SHA describes the Property and surrounding area as underlain by approximately 12 to 20 feet of silty sands overlying bedrock. The depth to bedrock was not reported. According to the Bedrock Geologic Map of Massachusetts by the U.S. Geological Survey dated 1983, the Cambridge Argillite underlies the area in the vicinity of the Property. SHA also reported the "... groundwater table is below the rock surface below the building, but above the rock on the southern end of the property..." and "...groundwater gradient in the bedrock and unconsolidated soils at the southeast end of the building is toward the south, angling toward Tufts Street."



Sanborn Maps dated 1888 through 1933 show that this area of Somerville included both residential and undeveloped lots. By 1961 a “laundry supplies” building was located on the Property, which was expanded in 1977. Several laundry supply distribution companies operated at the Property between the 1950s and 2002.

Father & Son recently occupied the building. It vacated the premises by December 31, 2004. The building has remained vacant since that time.

## **2.3 Surrounding Receptors**

The Property is located in a residential and commercial neighborhood (Fig. 2) and is abutted by:

- Railroad tracks to the west.
- Tufts Street and residences to the east.
- Michael E. Capuano Early Childhood Center (school), approximately 350 feet to the east.
- A parking garage and residences to the north.
- Washington Street, on which commercial buildings are located, to the south.

According to the Massachusetts Geographical Information System (MassGIS) Bureau of Waste Site Cleanup (BWSC) map for the Boston North Quadrangle dated December 10, 2004, the Site is not located within a Potentially Productive Aquifer (PPA) and no Sole Source Aquifers, Zone II Areas, Interim Wellhead Protection Areas, Areas of Critical Environmental Concern, Sole Source Aquifers, Protected Open Spaces, or Habitats of Species of Special Concern or Endangered Species, or Fish Habitats are located within 500 feet of the Site.

## **2.4 Description of Historic IRA Activities**

To date, four potentially responsible parties (PRP) have undertaken or have been directed by DEP to undertake IRAs associated with the Site:

- John Danais Company
- 50 Tufts Street, Inc.
- Somerville Two, LLC
- UniFirst Corporation



### **2.4.1 John Danias Company**

At the time SHA reported the Imminent Hazard associated with the indoor air testing data collected at the Property to DEP, DEP orally approved an IRA Plan to increase the ventilation in the office space and vacate the space as soon as an alternative location could be arranged. The ventilation in the office area was improved and tenants vacated the building by December 31, 2004. SHA submitted an IRA Completion Statement for RTN 3-24358 to DEP on February 2, 2005.

### **2.4.2 50 Tufts Street, Inc.**

On December 21, 2004, DEP issued a Notice of Response Action – Interim Deadline (NRA) to 50 Tufts Street, Inc. to evaluate indoor air at six residences across Tufts Street and evaluate utility lines within Tufts Street for the presence of Site-related contaminants that may pose a condition of SRM. If IRA actions were not initiated by January 11, 2005, the DEP gave notice that it would assign a contractor to carry out response actions. 50 Tufts Street, Inc. did not undertake the required response actions.

DEP conducted an indoor air screening program at residences located at 9, 11/13, 19, 25, and 27 Tufts Street. DEP contacted residents and obtained access agreements. On February 9, 2005, DEP conducted indoor air screening for chlorinated VOCs in the basement and first floor of each residence. The only analyte detected was 0.26 ppbv of PCE from the basement of 19 Tufts Street.

In February and March 2005, DEP coordinated the sampling of indoor air for laboratory testing at the residences located at 9, 11/13, 17, 19, 23, 25, and 27 Tufts Street. Shaw Environmental & Infrastructure (Shaw) of Andover, Massachusetts collected the samples. A 4-hour time-weighted average sample was collected from the basement and the first floor of each residence. Accutest Laboratories, Inc., of Marlborough, Massachusetts (Accutest), analyzed the samples for VOCs by U.S. Environmental Protection Agency (EPA) Method TO-15. PCE was detected in air samples from all of the residences except 27 Tufts Street. PCE concentrations ranged from 0.14 ppbv to 1.3 ppbv, with the highest concentration detected in a sample collected at 17 Tufts Street. All concentrations reported were below DEP published concentrations for PCE in residential indoor air.

### **2.4.3 Somerville Two, LLC**

Somerville Two, LLC is the current owner of the Property. On June 9, 2005, DEP issued a Notice of Need to Conduct IRA to Somerville Two. DEP had determined that based on the indoor air sampling results, a condition of SRM existed and that Somerville Two needed to conduct response actions necessary to abate the SRM. DEP required Somerville Two to



repair and seal the basement floor of 17 Tufts Street and eliminate pathways through openings in the walls.

Somerville Two responded that the indoor air testing results did not represent a condition of SRM, since the results were less than DEP published background concentrations for PCE in residences. DEP responded that, although concentrations were below published background concentrations, the concentrations of PCE measured in 17 and 19 Tufts Street relative to those in the other nearby residences nonetheless constituted an SRM. DEP therefore directed Somerville Two to undertake an IRA.

On September 6, 2005, GeoInsight submitted an IRA Plan to DEP to repair and seal the basement floor and portions of the wall at 17 Tufts Street. During September, GeoInsight repaired damaged areas of the concrete floor and wood paneling at 17 Tufts Street. A concrete latex-based sealer was applied to newly repaired sections of floor and those portions of the floor that were not recently painted by the owner.

On October 11, 2005, GeoInsight submitted an IRA Completion Statement to DEP. The Completion Statement concluded that response actions were completed since the potential Critical Exposure Pathways (broken concrete floor, utility manways and foundation cracks) were sealed. The Completion Report also reiterated that the concentrations of chlorinated VOCs from 17 Tufts Street were below published DEP background concentrations.

On October 20, 2005, DEP issued a Notice of Immediate Response Action Completion (IRAC) Statement Denial; Notice of Need to Conduct IRA; and Designation of Interim Deadline to Somerville Two. DEP did not consider the IRA complete since the entire basement floor at 17 Tufts Street was not sealed and there was no monitoring plan for collecting additional indoor air samples or groundwater samples. DEP required additional response actions of Somerville Two including technical justification for the continued use of DEP published background data or removal of its reference from the Report, sealing the remainder of the basement floor at 17 Tufts Street, a groundwater monitoring program for the wells along Tufts Street, and an indoor air sampling program for the residences at 17 and 19 Tufts Street.

Somerville Two submitted an IRA Plan Addendum to DEP dated November 29, 2005. The Plan indicated that the basement of 17 Tufts Street would be painted by 2 coats of latex-based paint. Two coats were applied by GeoInsight to the rear (eastern) portion of the basement. The owner was applying two coats of latex-based paint in the front portion of the basement. The IRA Plan Addendum included an indoor air monitoring program to be conducted at 17 and 19 Tufts Street in February 2006, which would be implemented if UniFirst did not conduct air sampling. The IRA Plan Addendum also assumed that additional groundwater monitoring would be conducted by UniFirst as part of Phase II activities.



## 2.5 UniFirst Corporation

On November 9, 2005, DEP issued a Notice of Responsibility, Notice of Need to Conduct IRA, and Designation of Interim Deadlines (Notice) to UniFirst Corporation to conduct an Imminent Hazard Evaluation (IHE) at the Property, to establish a monitoring plan for seven Tufts Street residences, and to evaluate potential impacts to other receptors.



### **3. Summary of IRA Activities – Indoor Air Sampling**

IRA activities performed from January 9 through April 14, 2006 included sampling and laboratory testing of indoor air in the basement and first floor living area at 9, 11/13, 15, 17, 19, 25, and 27 Tufts Street.

#### **3.1 Neighborhood Meeting and Correspondence**

Prior to conducting the indoor air testing in the residences along Tufts Street, UniFirst and GEI held a community meeting with the residents and the City. The purpose of the meeting was to explain to the residents UniFirst's involvement in the project, the scope of the indoor air testing program and to request their cooperation. With the assistance of Vithal Deshpande, the City of Somerville's Department of Public Works' Environmental Coordinator, GEI conducted a community meeting on March 14, 2006. The City sent a letter of introduction to the residents and notice of the community meeting, along with a letter from GEI seeking permission to conduct indoor air sampling at their residences. Copies of the letters from the City and GEI are in Appendix B.

UniFirst, GEI, representatives of the City, and residents met on March 14, 2006, at the Michael E. Capuano School. An attendance list from the meeting is in Appendix B. Following the neighborhood meeting, GEI arranged access with the individual home-owners to sample indoor air at their residences.

#### **3.2 Work Plan and Quality Assurance Project Plan**

Prior to conducting the indoor air sampling at the residences, GEI prepared a Work Plan and a Quality Assurance Project Plan (QAPP) to be followed during the indoor air sampling and testing program. The Work Plan and QAPP specify general sampling and data evaluation protocols and procedures to be followed during the program in order to achieve the data usability objectives of the MCP. Copies of the Work Plan and the QAPP are in Appendix C and D, respectively. Excursions from the Work Plan and QAPP will be noted in the Interim IRA Status Report.

#### **3.3 Indoor Air Sampling - Pre-Sampling Survey**

In accordance with DEP guidance, the Work Plan and QAPP, GEI requested permission from each home-owner and/or resident to conduct an indoor air pre-sampling survey and to remove materials that may potentially be off-gassing analytes that are being tested for in the



air samples. Copies of the Pre-Sampling Field Checklist for Indoor Air Sampling will be provided in the Interim IRA Status Report.. According to the residents, DEP did not remove materials from the homes prior to conducting their sampling events.

- We received permission and performed pre-sampling surveys more than 48 hours before the sampling at 23, 25, and 27 Tufts Street on March 21, 2006.
- The residents at 11/13 and 19 Tufts Street partially filled in the pre-sampling survey forms and provided them to GEI prior to the sampling.
- We performed pre-sampling surveys on the day of the sampling at 9 Tufts Street on March 23, 2006. We performed pre-sampling surveys on the day of sampling at 17 (basement only) Tufts Street on March 24, 2006. A pre-sampling survey form was not completed for the first floor at 17 Tufts Street due to resident constraints.

None of the residents permitted the removal of materials from their residences prior to sampling.

### **3.4 Air Sampling**

#### **3.4.1 Air Sampling – Checklist and Methods**

Air samples were collected in general accordance with the Work Plan and QAPP in Appendix C and D, respectively. Air samples were collected using polished stainless steel evacuated canisters (Summa canisters) and regulators provided by Accutest Laboratories of Marlborough, Massachusetts. Each canister was certified clean by Accutest, and copies of the certifications will be provided to DEP in an Interim IRA Status Report once the data is validated.

Sampling equipment was placed in the sampling location after completing an Ambient Air Sampling Checklist (copies of the checklists will be provided in the Interim IRA Status Report).

The regulator was attached to the canister at the location of the testing, and the pressure gauge reading was recorded. The canister was elevated so that the “candy cane” air inlet was approximately 3 to 5 feet above the floor. The canister position in the room was photographed (copies of the photographs will be provided in the Interim IRA Status Report). The laboratory set flow regulator was subsequently turned on and the time recorded. The regulator was turned off after approximately four hours, and the time and final pressure gauge reading recorded. Photographs of the canisters were not taken at the completion of sampling because, in general, the residents expressed concern about their homes being photographed.



### **3.4.2 Air Sampling – Locations and Duplicates**

Air samples and duplicate samples were collected at the locations shown on Figure 3. Two first floor living area samples were collected at 9 Tufts Street because two apartments are located on the first floor and according to the residents, DEP collected air samples in both apartments.

Duplicate air samples were collected at both 17 and 19 Tufts Street in the basements. The duplicate air samples were created by using a “T-splitter” and tubing attached to both canisters, so that both canisters were drawing from the same port.

Duplicate samples were submitted “blind” to the laboratory in accordance with the QAPP. In general, the purpose of the duplicates is to evaluate the ability of the laboratory to accurately replicate testing results.

### **3.4.3 Air Sampling - Exterior Samples**

A total of four exterior air samples were collected during the air sampling event.

- One exterior air sample (045160-Tufts-O-1A) was collected into a canister placed on the sidewalk just northeast of the corner of the Property (refer to Fig. 3) on March 23, 2006. GEI personnel watched the canister intermittently throughout the four hour collection period to prevent tampering. Construction activity was observed directly across the street at 49-47 Tufts Street. The construction involved the use of a Bobcat loader, and several dump trucks. Another sample (045160-Tufts-O-1B) was collected at the same location the next day, March 24, 2006.
- One exterior air sample (045160-Tufts-O-2A) canister was attached to a tree in front of 17 Tufts Street (refer to Fig. 3) on March 23, 2006. GEI personnel watched the canister intermittently throughout the four hour collection period to prevent tampering. Another sample (045160-Tufts-O-2B) was collected at the same location the next day, March 24, 2006.

The exterior air samples were collected to evaluate the background and exterior air conditions.

### **3.4.4 Air Sampling - Trip Blank**

A trip blank sample was submitted for laboratory analysis to demonstrate that VOC contamination of the sampling vessels did not occur during the transport of the canisters both to and from the sampling site, and the laboratory. The trip blank was left at the location of all samples for a small amount of time so that each location would be represented. The trip



blank was also transported with the other Summa canisters that were used to sample indoor and outdoor air. It was partially filled with inert clean gas upon return to the laboratory and then analyzed for VOCs using the TO-15 method.

### 3.5 Meteorological Conditions

On the first day of sampling, the outdoor temperature during sampling ranged from 48 degrees Fahrenheit (°F) to 60°F. Wind direction changed from south-south-east in the morning to south in the afternoon. Barometric pressure was measured to be 29.95 in-Hg when sampling commenced in the morning and 29.93 in-Hg at the time of sampling completion.

Throughout the second day of sampling, the outdoor temperature ranged from 44°F to 51°F. Wind direction kept steady heading south-south-east. Barometric pressure was measured to be 30.12 in-Hg when sampling commenced in the morning and 30.09 in-Hg at the time of sampling completion.

There were no precipitation events for at least 12 hours proceeding the sampling period, as well as during the sample period itself.

Meteorological measurements were made with a Vantage Pro portable weather station.

### 3.6 Indoor Air Chemical Testing

The air samples were submitted to Accutest Laboratories of Marlborough, Massachusetts for chemical testing by EPA Method TO-15. The EPA method TO-15 was modified to report the same analytes reported by DEP during the indoor air testing conducted in 2005.

- |                              |                             |
|------------------------------|-----------------------------|
| ▪ Chloroethane               | ▪ cis-1,2-Dichloroethylene  |
| ▪ Chloroform                 | ▪ Methylene Chloride        |
| ▪ Chloromethane              | ▪ 1,1,1-Trichloroethane     |
| ▪ Carbon Tetrachloride       | ▪ 1,1,2,2-Tetrachloroethane |
| ▪ 1,1-Dichloroethane         | ▪ 1,1,2-Trichloroethane     |
| ▪ 1,1-Dichloroethylene       | ▪ Tetrachloroethylene       |
| ▪ 1,2-Dichloroethane         | ▪ Trichloroethylene         |
| ▪ trans-1,2-Dichloroethylene | ▪ Vinyl Chloride            |

The results of the indoor air testing will be provided to DEP in an Interim IRA Status Report once the data have been validated.



## **4. Summary of IRA Activities – Subsurface and Utility Line Investigations**

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GEI is currently obtaining permits and access agreements associated with the installation of borings and monitoring wells to evaluate the shallow subsurface groundwater plume.

### **4.1 City of Somerville Permits**

GEI prepared and submitted a Grant of Easement permit application to the City of Somerville to install five borings and monitoring wells in the completed borings. The purpose of the borings and monitoring wells is to evaluate the shallow groundwater plume in the vicinity of the Property. GEI met with the Board of Alderman on April 11, 2006, at which time the Board granted approval to conduct the borings and install the monitoring wells.

Following receipt of the Grant of Easements, GEI submitted applications for street opening permits with the City of Somerville to perform the borings. The borings and monitoring wells will be installed, and the first round of groundwater sampling will be undertaken during April and May of 2006.

### **4.2 50 Tufts Street Access Agreement**

UniFirst recently finalized an access agreement with Somerville Two, LLC, the current owner of the Property. Now that the access agreement has been finalized, GEI will move forward with surveying the existing wells and collecting groundwater samples.

### **4.3 Evaluate Utility Lines**

GEI is collecting and reviewing readily-available plans for underground utilities, particularly on Tufts Street, to evaluate whether underground utilities may be preferential migration pathways. Information collected during the installation of the proposed borings and well will be needed to continue the utility line evaluation.



## 5. Schedule

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IRA activities began in January 2006 in accordance with the schedule shown below. The schedule has been adjusted to reflect the time required to obtain access authorizations and applicable City permits. GEI will submit IRA status reports every six months until an IRA Completion Report is submitted to DEP.

IRA Activity Schedule	Schedule
Imminent Hazard Evaluation	Completed
Indoor Air Monitoring, 17 & 19 Tufts Street	Completed First Quarter (March 2006)
Indoor Air Monitoring, Other Tufts Street Residences	Completed First Semi-Annual (March 2006)
Indoor Air Monitoring, 17 & 19 Tufts Street	Quarterly (June, Sept., Dec. 2006)
Indoor Air Monitoring, Other Tufts Street Residences	Semi-Annual (Sept. 2006)
Soil Borings & Monitoring Well Installations	April – May 2006
Groundwater Sampling	Quarterly (June, Sept., Dec. 2006, and Mar. 2007)
Utility Line Evaluation	May - June 2006
IRA Status Report No. 2	November 2006



## 6. Limitations

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This IRA Status Report was prepared for the use of UniFirst Corporation, exclusively. The conclusions presented in this report are based solely on the information reported in this document. Additional information regarding the Property and surrounding area not available to GEI may result in a modification of the findings herein. The submittal has been prepared in accordance with generally accepted geohydrological practices. No warranty, expressed or implied, is made.





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**Table 1**  
**Summary of Sample Locations and Dates**  
**50 Tufts Street**  
**Somerville, Massachusetts**

Sample ID	Sample Location Description	Sample Date
045160 - 9Tufts - BR	On workbench under right apartment.	3/23/2006
045160 - 9Tufts - 1R	On kitchen table against far wall.	3/23/2006
045160 - 9Tufts - 1L	On counter separating kitchen and living area.	3/23/2006
045160 - 11/13Tufts - B	On living room coffee table in center of room.	3/24/2006
045160 - 11/13Tufts - 1	On bookshelf in center of basement.	3/24/2006
045160 - 17Tufts - C	On desk in center of basement.	3/24/2006
045160 - 17Tufts - B	On desk in center of basement.	3/24/2006
045160 - 17Tufts - 1	On chair in living room.	3/24/2006
045160 - 19Tufts - C	On lawn furniture/boxes near wall of basement.	3/23/2006
045160 - 19Tufts - B	On lawn furniture/boxes near wall of basement.	3/23/2006
045160 - 19Tufts - 1	On table in center of kitchen.	3/23/2006
045160 - 23Tufts - B	On desk against wall in basement.	3/24/2006
045160 - 23Tufts - 1	On kitchen counter.	3/24/2006
045160 - 25Tufts - B	On table/boxes in left portion of vacant basement.	3/23/2006
045160 - 25Tufts - 1	On table/boxes in center of vacant living room.	3/23/2006
045160 - 27Tufts - B	On workbench near center of basement.	3/23/2006
045160 - 27Tufts - 1	On boxes on coffee table in living room.	3/23/2006
045160 - Tufts - O - 1A	Attached to fence post on northwest side of Tufts Street.	3/23/2006
045160 - Tufts - O - 1B	Attached to fence post on northwest side of Tufts Street.	3/24/2006
045160 - Tufts - O - 2A	Attached to tree outside of 17 Tufts Street.	3/23/2006
045160 - Tufts - O - 2B	Attached to tree outside of 17 Tufts Street.	3/24/2006

**Note:**

Refer to Ambient Air Sampling Checklists for additional information.

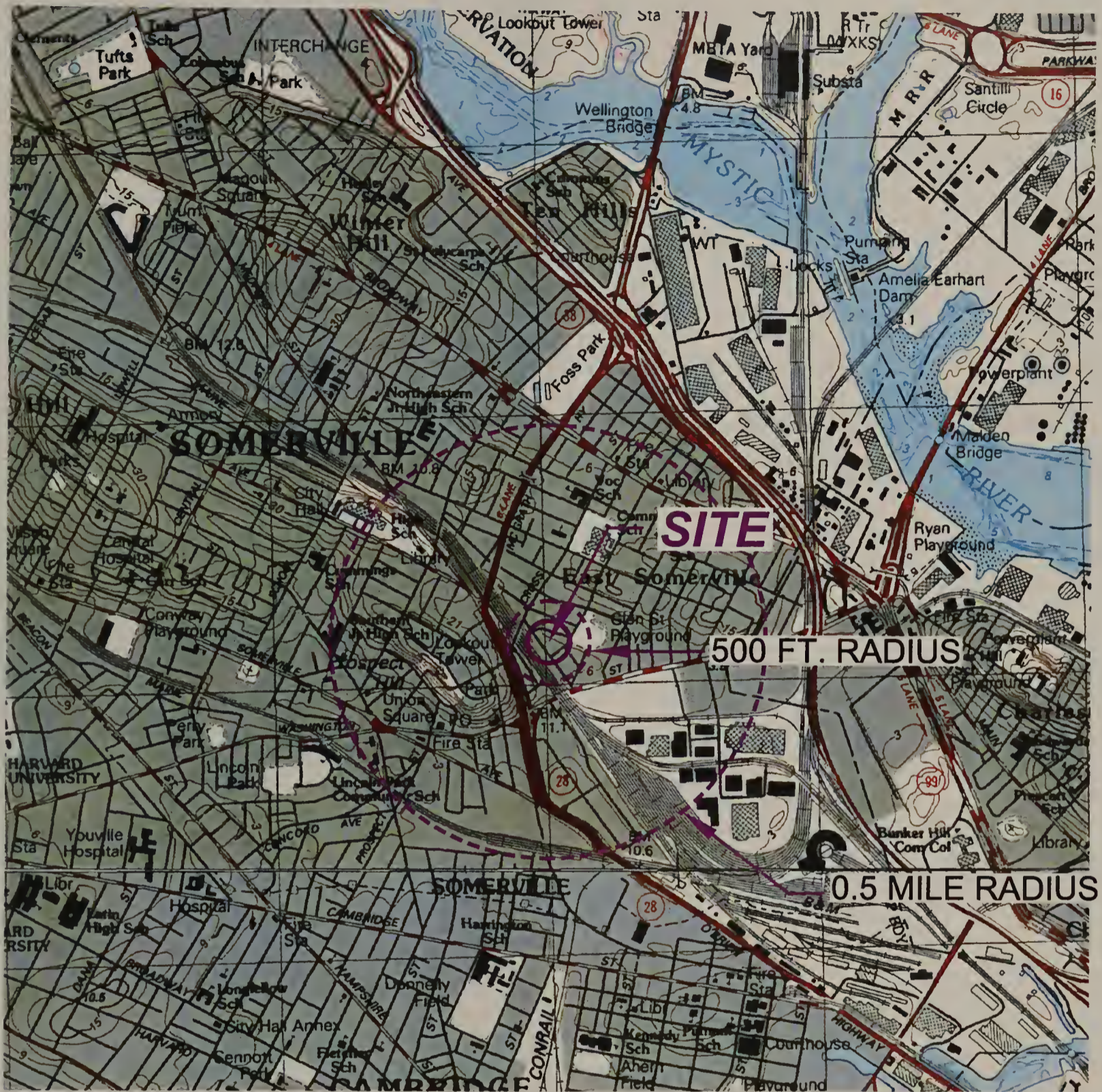




Geotechnical  
Environmental and  
Water Resources  
Engineering







This Image provided by MassGIS is taken from  
U.S.G.S. Topographic 7.5 X 15 Minute Series  
Boston North, MA Quadrangle, 1985.  
Datum is National Geodetic Vertical Datum (NGVD).  
Contour Interval is 3 Meters.

Immediate Response Action Status Report No. 1  
50 Tufts Street  
Somerville, Massachusetts  
UniFirst Corporation  
Wilmington, Massachusetts



Project 045160

SITE LOCATION MAP

May 2006

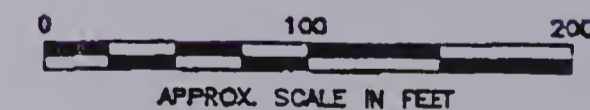
Fig. 1





**LEGEND:**

- ▲ 045160-9Tufts-1L APPROXIMATE AIR SAMPLING LOCATION
- APPROXIMATE WEATHER STATION LOCATION



**NOTES:**

1. THIS PLAN WAS DERIVED FROM A DRAFT PLAN PREPARED BY GEOINSIGHT TITLED "SITE PLAN," DATED 8/23/04.
2. BUILDINGS SHOWN ON THIS PLAN WERE TRANSPOSED FROM THE CITY OF SOMERVILLE ASSESSORS MAP NO. 93, DATED JANUARY 3, 2001.

Immediate Response Action Status Report No. 1  
 50 Tufts Street  
 Somerville, Massachusetts  
 UniFirst Corporation  
 Wilmington, Massachusetts



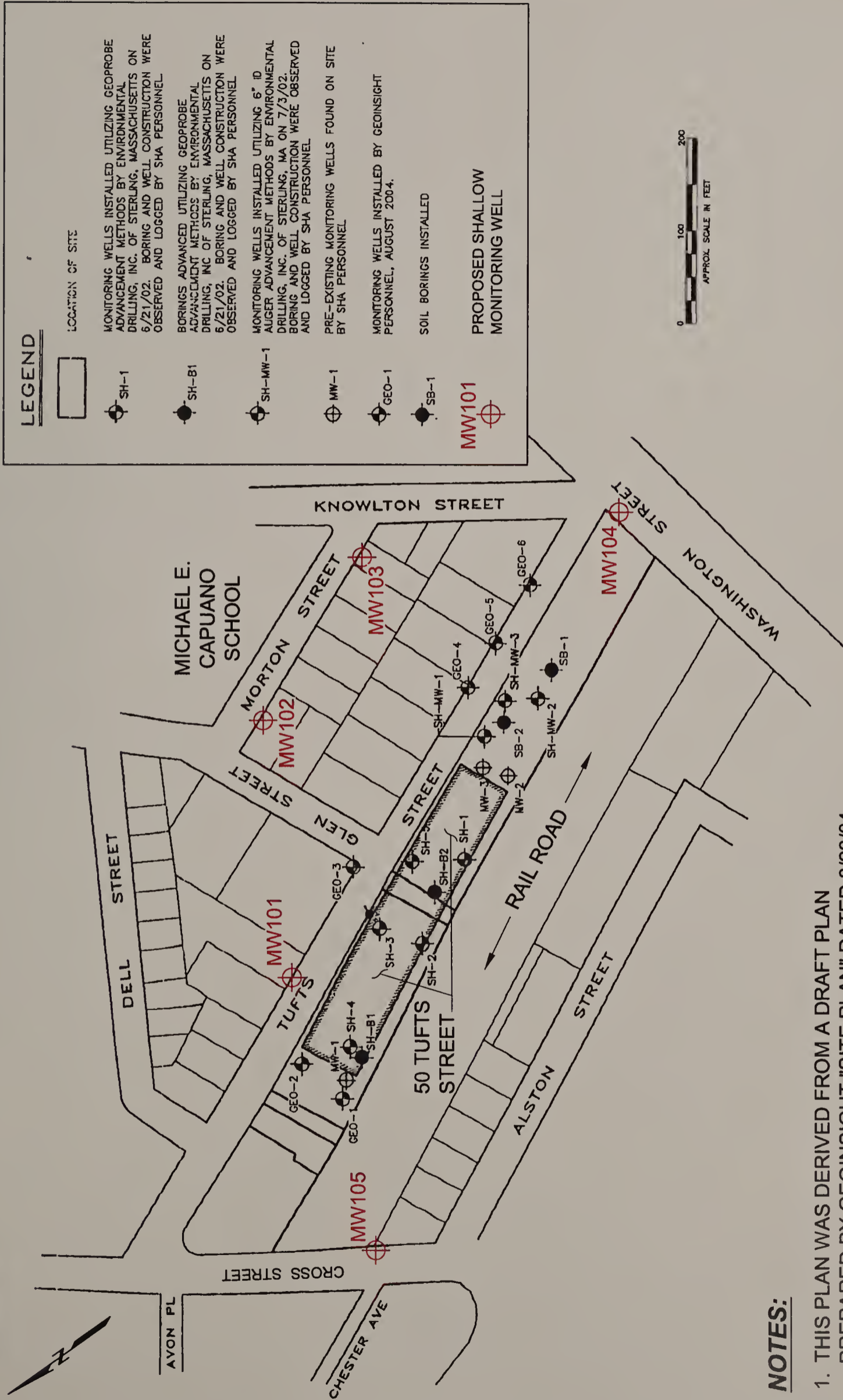
AIR SAMPLING LOCATIONS

Project 045160

May 2006

Fig. 2





**NOTES:**

1. THIS PLAN WAS DERIVED FROM A DRAFT PLAN PREPARED BY GEOINSIGHT "SITE PLAN" DATED 8/23/04.

Immediate Response Action Status Report No. 1  
50 Tufts Street  
Somerville, Massachusetts  
UniFirst Corporation  
Wilmington, Massachusetts

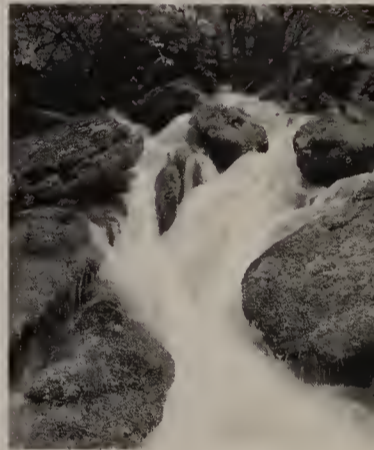
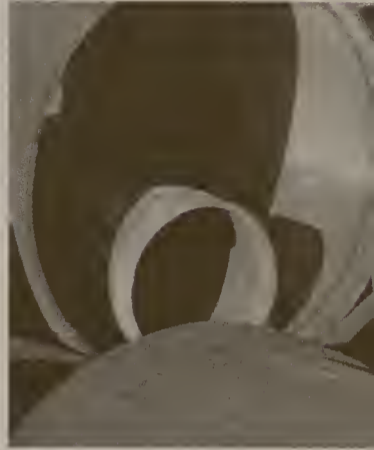


**PROPOSED SUBSURFACE INVESTIGATIONS**





Geotechnical  
Environmental and  
Water Resources  
Engineering





## Appendix A

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### Copy of IRA Status Report Transmittal Form (BWSC105)





Massachusetts Department of Environmental Protection  
Bureau of Waste Site Cleanup

BWSC105

**IMMEDIATE RESPONSE ACTION (IRA) TRANSMITTAL  
FORM** Pursuant to 310 CMR 40.0424 - 40.0427 (Subpart D)

Release Tracking Number

3

-

23246

**A. RELEASE OR THREAT OF RELEASE LOCATION:**

1. Release Name/Location Aid: \_\_\_\_\_

2. Street Address: 50 Tufts Street

3. City/Town: Somerville

4. ZIP Code: 02145

☐ 5. Check here if a Tier Classification Submittal has been provided to DEP for this disposal site.

☐ a. Tier IA ☐ b. Tier IB ☐ c. Tier IC ☐ d. Tier II

☐ 6. Check here if this location is Adequately Regulated, pursuant to 310 CMR 40.0110-0114. Specify Program (check one):

☐ a. CERCLA ☐ b. HSWA Corrective Action ☐ c. Solid Waste Management

☐ d. RCRA State Program (21C Facilities)

**B. THIS FORM IS BEING USED TO:** (check all that apply)

1. List Submittal Date of Initial IRA Written Plan (if previously submitted): 01/09/2006

(mm/dd/yyyy)

☐ 2. Submit an **Initial IRA Plan**.

☐ 3. Submit a **Modified IRA Plan** of a previously submitted written IRA Plan.

☐ 4. Submit an **Imminent Hazard Evaluation**. (check one)

☐ a. An Imminent Hazard exists in connection with this Release or Threat of Release.

☐ b. An Imminent Hazard does not exist in connection with this Release or Threat of Release.

☐ c. It is unknown whether an Imminent Hazard exists in connection with this Release or Threat of Release, and further assessment activities will be undertaken.

☐ d. It is unknown whether an Imminent Hazard exists in connection with this Release or Threat of Release. However, response actions will address those conditions that could pose an Imminent Hazard.

☐ 5. Submit a request to **Terminate an Active Remedial System or Response Action(s) Taken to Address an Imminent Hazard**.

☒ 6. Submit an **IRA Status Report**.

☐ 7. Submit an **IRA Completion Statement**.

☐ a. Check here if future response actions addressing this Release or Threat of Release notification condition will be conducted as part of the Response Actions planned or ongoing at a Site that has already been Tier Classified under a different Release Tracking Number (RTN). When linking RTNs, rescoring via the NRS is required if there is a reasonable likelihood that the addition of the new RTN(s) would change the classification of the site.

b. Provide Release Tracking Number of Tier Classified Site (Primary RTN):  -

These additional response actions must occur according to the deadlines applicable to the Primary RTN. Use the Primary RTN when making all future submittals for the site unless specifically relating to this Immediate Response Action.

☐ 8. Submit a **Revised IRA Completion Statement**.

(All sections of this transmittal form must be filled out unless otherwise noted above)



Massachusetts Department of Environmental Protection  
Bureau of Waste Site Cleanup

BWSC105

IMMEDIATE RESPONSE ACTION (IRA) TRANSMITTAL  
FORM Pursuant to 310 CMR 40.0424 - 40.0427 (Subpart D)

Release Tracking Number

3

-

23246

C. RELEASE OR THREAT OF RELEASE CONDITIONS THAT WARRANT IRA:

1. Identify Media Impacted and Receptors Affected: (check all that apply)

- ☒ a. Air ☒ b. Basement ☒ c. Critical Exposure Pathway ☒ d. Groundwater ☒ e. Residence  
☐ f. Paved Surface ☐ g. Private Well ☐ h. Public Water Supply ☐ i. School ☐ j. Sediments  
☐ k. Soil ☐ l. Storm Drain ☐ m. Surface Water ☐ n. Unknown ☐ o. Wetland ☐ p. Zone 2  
☐ q. Others Specify: \_\_\_\_\_

2. Identify Oils and Hazardous Materials Released: (check all that apply)

- ☐ a. Oils ☒ b. Chlorinated Solvents ☐ c. Heavy Metals  
☐ d. Others Specify: \_\_\_\_\_

D. DESCRIPTION OF RESPONSE ACTIONS: (check all that apply, for volumes list cumulative amounts)

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> 1. Assessment and/or Monitoring Only     | <input type="checkbox"/> 2. Temporary Covers or Caps                        |
| <input type="checkbox"/> 3. Deployment of Absorbent or Containment Materials | <input type="checkbox"/> 4. Temporary Water Supplies                        |
| <input type="checkbox"/> 5. Structure Venting System                         | <input type="checkbox"/> 6. Temporary Evacuation or Relocation of Residents |
| <input type="checkbox"/> 7. Product or NAPL Recovery                         | <input type="checkbox"/> 8. Fencing and Sign Posting                        |
| <input type="checkbox"/> 9. Groundwater Treatment Systems                    | <input type="checkbox"/> 10. Soil Vapor Extraction                          |
| <input type="checkbox"/> 11. Bioremediation                                  | <input type="checkbox"/> 12. Air Sparging                                   |
| <input type="checkbox"/> 13. Excavation of Contaminated Soils                |   |

☐ a. Re-use, Recycling or Treatment ☐ i. On Site Estimated volume in cubic yards \_\_\_\_\_

☐ ii. Off Site Estimated volume in cubic yards \_\_\_\_\_

iiia. Receiving Facility: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_

iiib. Receiving Facility: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_

iii. Describe: \_\_\_\_\_

☐ b. Store ☐ i. On Site Estimated volume in cubic yards \_\_\_\_\_

☐ ii. Off Site Estimated volume in cubic yards \_\_\_\_\_

iiia. Receiving Facility: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_

iiib. Receiving Facility: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_



**IMMEDIATE RESPONSE ACTION (IRA) TRANSMITTAL  
FORM** Pursuant to 310 CMR 40.0424 - 40.0427 (Subpart D)

Release Tracking Number

3

-

23246

**D. DESCRIPTION OF RESPONSE ACTIONS (cont.):** (check all that apply, for volumes list cumulative amounts)

☐ c. Landfill

☐ i. Cover Estimated volume in cubic yards \_\_\_\_\_

Receiving Facility: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_

☐ ii. Disposal Estimated volume in cubic yards \_\_\_\_\_

Receiving Facility: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_

☐ 14. Removal of Drums, Tanks or Containers:

a. Describe Quantity and Amount: \_\_\_\_\_  
\_\_\_\_\_

b. Receiving Facility: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_

c. Receiving Facility: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_

☐ 15. Removal of Other Contaminated Media:

a. Specify Type and Volume: \_\_\_\_\_  
\_\_\_\_\_

b. Receiving Facility: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_

c. Receiving Facility: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_

☐ 16. Other Response Actions:

Describe: \_\_\_\_\_  
\_\_\_\_\_

☐ 17. Use of Innovative Technologies:

Describe: \_\_\_\_\_



Massachusetts Department of Environmental Protection  
Bureau of Waste Site Cleanup

BWSC105

IMMEDIATE RESPONSE ACTION (IRA) TRANSMITTAL  
FORM Pursuant to 310 CMR 40.0424 - 40.0427 (Subpart D)

Release Tracking Number

3

-

23246

E. LSP SIGNATURE AND STAMP:

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and 309 CMR 4.03(2), and (iii) the provisions of 309 CMR 4.03(3), to the best of my knowledge, information and belief,

> if Section B of this form indicates that an **Immediate Response Action Plan** is being submitted, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> if Section B of this form indicates that an **Imminent Hazard Evaluation** is being submitted, this Imminent Hazard Evaluation was developed in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and the assessment activity(ies) undertaken to support this Imminent Hazard Evaluation comply(ies) with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000;

> if Section B of this form indicates that an **Immediate Response Status Report** is being submitted, the response action(s) that is (are) the subject of this submittal (i) is (are) being implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal;

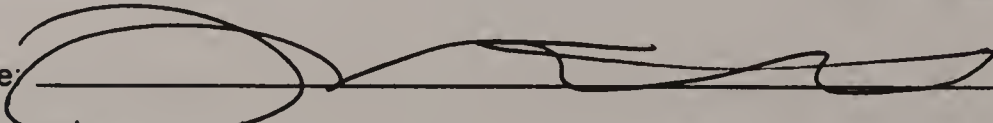
> if Section B of this form indicates that an **Immediate Response Action Completion Statement** or a request to **Terminate an Active Remedial System or Response Action(s) Taken to Address an Imminent Hazard** is being submitted, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal.

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

1. LSP #: 9719

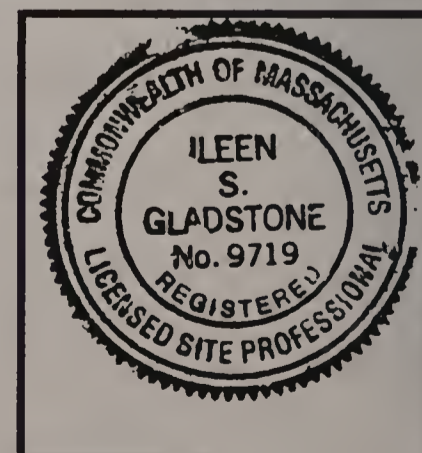
2. First Name: Ileen S. 3. Last Name: Gladstone

4. Telephone: (781) 721-4012 5. Ext.: 6. FAX: (781) 721-4073

7. Signature: 

8. Date: 5/8/06  
(mm/dd/yyyy)

9. LSP Stamp:





Massachusetts Department of Environmental Protection  
Bureau of Waste Site Cleanup

BWSC105

IMMEDIATE RESPONSE ACTION (IRA) TRANSMITTAL  
FORM Pursuant to 310 CMR 40.0424 - 40.0427 (Subpart D)

Release Tracking Number

3 - 23246

F. PERSON UNDERTAKING IRA:

1. Check all that apply: ☐ a. change in contact name ☐ b. change of address ☐ c. change in the person undertaking response actions

2. Name of Organization: UniFirst Corporation

3. Contact First Name: Brian 4. Last Name: Keegan

5. Street: 68 Jonspin Road 6. Title: Senior Engineering Manager

7. City/Town: Wilmington 8. State: MA 9. ZIP Code: 01887

10. Telephone: (978) 658-8888 11. Ext.: 645 12. FAX: \_\_\_\_\_

G. RELATIONSHIP TO RELEASE OR THREAT OF RELEASE OF PERSON UNDERTAKING IRA:

☒ 1. RP or PRP ☐ a. Owner ☐ b. Operator ☐ c. Generator ☐ d. Transporter

☒ e. Other RP or PRP Specify: corporate affiliation with previous owner of property

☐ 2. Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ 3. Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ 4. Any Other Person Undertaking IRA Specify Relationship: \_\_\_\_\_

H. REQUIRED ATTACHMENT AND SUBMITTALS:

☐ 1. Check here if any Remediation Waste, generated as a result of this IRA, will be stored, treated, managed, recycled or reused at the site following submission of the IRA Completion Statement. If this box is checked, you must submit one of the following plans, along with the appropriate transmittal form.

☐ a. A Release Abatement Measure (RAM) Plan (BWSC106) ☐ b. Phase IV Remedy Implementation Plan (BWSC108)

☐ 2. Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

☐ 3. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the implementation of an Immediate Response Action taken to control, prevent, abate or eliminate an Imminent Hazard.

☐ 4. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the submittal of a Completion Statement for an Immediate Response Action taken to control, prevent, abate or eliminate an Imminent Hazard.

☐ 5. Check here if any non-updatable information provided on this form is incorrect, e.g. Release Address/Location Aid. Send corrections to the DEP Regional Office.

☒ 6. Check here to certify that the LSP Opinion containing the material facts, data, and other information is attached.



**Massachusetts Department of Environmental Protection**  
*Bureau of Waste Site Cleanup*

**BWSC105**

**IMMEDIATE RESPONSE ACTION (IRA) TRANSMITTAL FORM**  
Pursuant to 310 CMR 40.0424 - 40.0427 (Subpart D)

Release Tracking Number  
**3** - **23246**

**I. CERTIFICATION OF PERSON UNDERTAKING IRA:**

1. I, Brian Keegan, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

2. By: *Brian E Keegan* 3. Title: Senior Engineering Manager  
Signature

4. For: UniFirst Corporation 5. Date: 04/17/2006  
(Name of person or entity recorded in Section F) (mm/dd/yyyy)

☐ 6. Check here if the address of the person providing certification is different from address recorded in Section F.

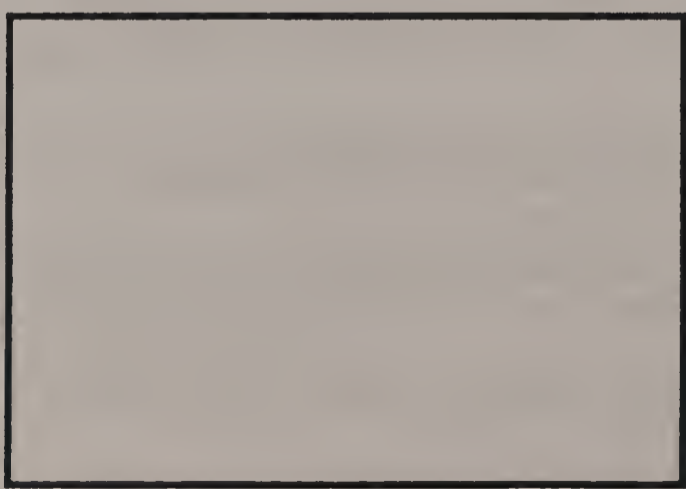
7. Street: \_\_\_\_\_

8. City/Town: \_\_\_\_\_ 9. State: \_\_\_\_\_ 10. ZIP Code: \_\_\_\_\_

11. Telephone: \_\_\_\_\_ 12. Ext.: \_\_\_\_\_ 13. FAX: \_\_\_\_\_

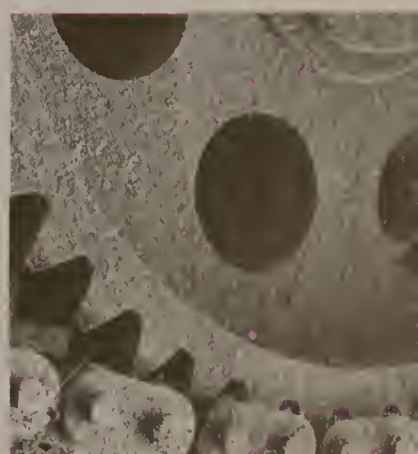
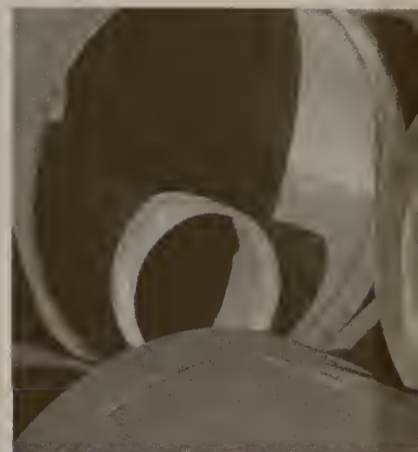
**YOU MUST LEGIBLY COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE.**

Date Stamp (DEP USE ONLY:)





Geotechnical  
Environmental and  
Water Resources  
Engineering





## Appendix B

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**Copies of City of Somerville and GEI Letters, and Neighborhood Meeting (March 14, 2006) Sign-In Form**



# Contact Information

Name	Street Address	Mailing Address	Home Phone #	Cellular Phone #	Email address	Best time to call
Candace Campbell		43 Highland Ave Somerville, MA 02143	617-625-6620 ext 2517	N/A	ccampbell@i-somerville.ma.us	
Vithal V-Deshpande		1 Franey Rd Somerville, MA 02144	617-625-6600 X5070			
MARK C. ENSIGN	GEI	WINCHESTER				
Steve Aquilino	Unifirst	Wilmington MA				
Krista Wolfe	GEI	Winchester		(781) 721-9909	Kwofp@geiconsultants.com	
JEFFrey INVERNIZIO	19 Tufts St	Somerville		857-222-4620		
Dolores DeVellis	11 Tufts St	Somerville 02145	(617) 628-5238	—	ddevellis@earthlink.net	anytime
RICHARD P. PAPPAS	27 Tufts St	Somerville 02145	617-625-7356		PAPPAS@RCN.COM	
PAUL RAPPAS	19 Tufts St	SOMERVILLE	617-625-7256			
AVANI CAMPOS	9 Tufts St	SOMERVILLE	617-501-6806		PO Box 423 SOMERVILLE, MA 02143	ANY TIME
JOHN BURNI	25 Tufts St	SOMERVILLE	617-625-2468			
Ireen Gladstone	GEI	Winchester	617-742-2588			



CITY OF SOMERVILLE, MASSACHUSETTS  
JOSEPH A. CURTATONE  
MAYOR

March 10, 2006

Dear Tufts Street Resident,

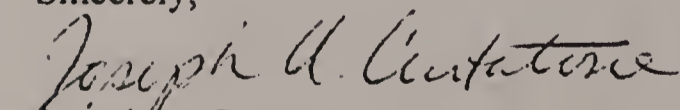
I am writing to give you a brief update on the remediation process for the contaminated site at 50 Tufts Street. As you know, the City is working closely with the DEP to address this important health and safety issue, and is determined to achieve a complete cleanup and provide a pollution-free environment for you and your neighbors.

By now, DEP should already have tested your home for potentially harmful indoor air pollution. In addition, DEP has identified several parties potentially responsible for the contamination of the 50 Tufts Street site. One of these, UniFirst, has voluntarily agreed to undertake a full cleanup of the contaminated site, and has hired GEI consultants to do the job. As a part of the process, GEI plans to conduct additional indoor air quality testing to make sure there are no environmental or health hazards that require additional remediation. Somerville's Environmental Protection Office is assisting in coordinating these efforts.

There will be a neighborhood meeting on March 14<sup>th</sup> to discuss the entire cleanup project. The meeting will be held at Cafeteria of Capuano School at 7:00 PM. A formal letter from GEI is enclosed for your information. If you have any questions, please feel free to contact the Environmental Coordinator, Vithal Deshpande at (617) 625-6600x5070.

Thank you.

Sincerely,

  
Joseph A. Curtatone

Mayor



March 2, 2006  
Project 04516-0



Mr. Campos Avani  
P.O. Box 423  
Somerville, MA 02143

Dear Mr. Avani:

**Re: Indoor Air Sampling  
9 Tufts Street  
Somerville, Massachusetts**

In 2005, the Massachusetts Department of Environmental Protection (DEP) contacted you and made arrangements to conduct indoor air testing for tetrachloroethylene (PCE) and other compounds in your home. DEP provided you with a letter summarizing the results of its testing, reporting that any PCE detected in your home was below DEP's "threshold limit" for "significant risk of harm to health over a short period of time" and "below the levels DEP typically finds in homes."

DEP has requested that additional rounds of air testing be conducted in your home periodically over the course of the next year, using the same sampling and laboratory testing methods, to create a more complete sampling record. Although DEP has identified several "potentially responsible parties" and asked each to cooperate in this effort, only one – UniFirst Corporation – has agreed to proceed voluntarily with the work that DEP requested. UniFirst has engaged GEI Consultants, Inc. (GEI), an environmental consulting firm, to conduct the testing.

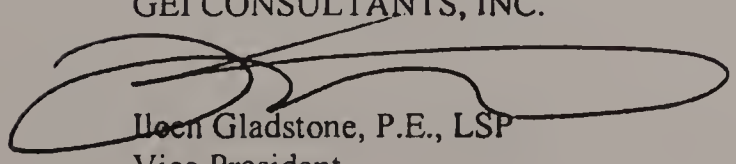
GEI is working with the city of Somerville and with DEP to ensure that the testing process is fully explained and that you and other neighbors have an opportunity to ask any questions you may have. The city is making arrangements to hold a neighborhood meeting on Tuesday, March 14, 2006, for that purpose. GEI will attend the neighborhood meeting and will respond to any questions you may have.

After the neighborhood meeting, we will be contacting you to arrange for the indoor air testing. We are planning to conduct two rounds of indoor air testing at your property over the next year, in March and August 2006. The indoor air testing is similar to the testing conducted by the DEP in 2005. During each round of testing, we will collect two samples over a 4-hour time period, one sample from the basement area, and one from the first floor area. After laboratory testing of the air samples is complete we will send the results of the assessment to you.

Thank you in advance for your assistance. We look forward to working with you and the other residents along Tufts Street. If you have any questions please do not hesitate to contact me at 781-721-4012.

Sincerely,

GEI CONSULTANTS, INC.



Helen Gladstone, P.E., LSP  
Vice President

ISG:cc

N:\04516\GEI Indoor Air Sampling Notice\_Mar2.DOC



March 2, 2006  
Project 04516-0

Ms. Delores Devellis  
11 Tufts Street  
Somerville, MA 02145

Geotechnical  
Environmental and  
Water Resources  
Engineering

Dear Ms. Devellis:

**Re: Indoor Air Sampling  
11/13 Tufts Street  
Somerville, Massachusetts**

In 2005, the Massachusetts Department of Environmental Protection (DEP) contacted you and made arrangements to conduct indoor air testing for tetrachloroethylene (PCE) and other compounds in your home. DEP provided you with a letter summarizing the results of its testing, reporting that any PCE detected in your home was below DEP's "threshold limit" for "significant risk of harm to health over a short period of time" and "below the levels DEP typically finds in homes."

DEP has requested that additional rounds of air testing be conducted in your home periodically over the course of the next year, using the same sampling and laboratory testing methods, to create a more complete sampling record. Although DEP has identified several "potentially responsible parties" and asked each to cooperate in this effort, only one – UniFirst Corporation – has agreed to proceed voluntarily with the work that DEP requested. UniFirst has engaged GEI Consultants, Inc. (GEI), an environmental consulting firm, to conduct the testing.

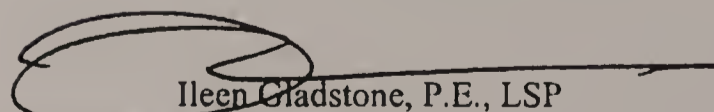
GEI is working with the city of Somerville and with DEP to ensure that the testing process is fully explained and that you and other neighbors have an opportunity to ask any questions you may have. The city is making arrangements to hold a neighborhood meeting on Tuesday, March 14, 2006, for that purpose. GEI will attend the neighborhood meeting and will respond to any questions you may have.

After the neighborhood meeting, we will be contacting you to arrange for the indoor air testing. We are planning to conduct two rounds of indoor air testing at your property over the next year, in March and August 2006. The indoor air testing is similar to the testing conducted by the DEP in 2005. During each round of testing, we will collect two samples over a 4-hour time period, one sample from the basement area, and one from the first floor area. After laboratory testing of the air samples is complete we will send the results of the assessment to you.

Thank you in advance for your assistance. We look forward to working with you and the other residents along Tufts Street. If you have any questions please do not hesitate to contact me at 781-721-4012.

Sincerely,

GEI CONSULTANTS, INC.



Ilse Gladstone, P.E., LSP  
Vice President

ISG:cc  
N:\04516\GEI Indoor Air Sampling Notice\_Mar2.DOC

March 2, 2006  
Project 04516-0



Mr. & Ms. Prevost  
17 Tufts Street  
Somerville, MA 02145

Dear Mr. & Mrs. Prevost:

**Re: Indoor Air Sampling  
17 Tufts Street  
Somerville, Massachusetts**

In 2005, the Massachusetts Department of Environmental Protection (DEP) contacted you and made arrangements to conduct indoor air testing for tetrachloroethylene (PCE) and other compounds in your home. DEP provided you with a letter summarizing the results of its testing, reporting that any PCE detected in your home was below DEP's "threshold limit" for "significant risk of harm to health over a short period of time" and "below the levels DEP typically finds in homes."

DEP has requested that additional rounds of air testing be conducted in your home periodically over the course of the next year, using the same sampling and laboratory testing methods, to create a more complete sampling record. Although DEP has identified several "potentially responsible parties" and asked each to cooperate in this effort, only one – UniFirst Corporation – has agreed to proceed voluntarily with the work that DEP requested. UniFirst has engaged GEI Consultants, Inc. (GEI), an environmental consulting firm, to conduct the testing.

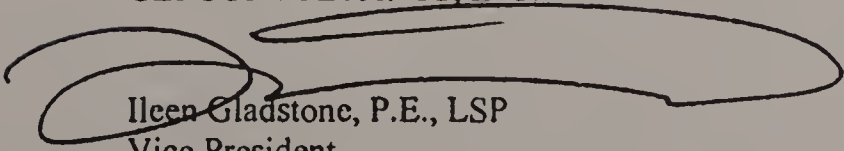
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After the neighborhood meeting, we will be contacting you to arrange for the indoor air testing. We are planning to conduct four rounds of indoor air testing at your property over the next year, in March, May, August, and November 2006. The indoor air testing is similar to the testing conducted by the DEP in 2005. During each round of testing, we will collect two samples over a 4-hour time period, one sample from the basement area, and one from the first floor area. After laboratory testing of the air samples is complete we will send the results of the assessment to you.

Thank you in advance for your assistance. We look forward to working with you and the other residents along Tufts Street. If you have any questions please do not hesitate to contact me at 781-721-4012.

Sincerely,

GEI CONSULTANTS, INC.



Ilcen Gladstone, P.E., LSP  
Vice President

ISG:cc  
N:\04516\GEI Indoor Air Sampling Notice\_Mar2.DOC

March 2, 2006  
Project 04516-0



Mr. Gerald Laurentano  
19 Tufts Street  
Somerville, MA 02145

Dear Mr. Laurentano:

**Re: Indoor Air Sampling  
19 Tufts Street  
Somerville, Massachusetts**

In 2005, the Massachusetts Department of Environmental Protection (DEP) contacted you and made arrangements to conduct indoor air testing for tetrachloroethylene (PCE) and other compounds in your home. DEP provided you with a letter summarizing the results of its testing, reporting that any PCE detected in your home was below DEP's "threshold limit" for "significant risk of harm to health over a short period of time" and "below the levels DEP typically finds in homes."

DEP has requested that additional rounds of air testing be conducted in your home periodically over the course of the next year, using the same sampling and laboratory testing methods, to create a more complete sampling record. Although DEP has identified several "potentially responsible parties" and asked each to cooperate in this effort, only one – UniFirst Corporation – has agreed to proceed voluntarily with the work that DEP requested. UniFirst has engaged GEI Consultants, Inc. (GEI), an environmental consulting firm, to conduct the testing.

GEI is working with the city of Somerville and with DEP to ensure that the testing process is fully explained and that you and other neighbors have an opportunity to ask any questions you may have. The city is making arrangements to hold a neighborhood meeting on Tuesday, March 14, 2006, for that purpose. GEI will attend the neighborhood meeting and will respond to any questions you may have.

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Thank you in advance for your assistance. We look forward to working with you and the other residents along Tufts Street. If you have any questions please do not hesitate to contact me at 781-721-4012.

Sincerely,

GEI CONSULTANTS, INC.

A handwritten signature in black ink, appearing to read "Helen Gladstone", written over a horizontal line.

Helen Gladstone, P.E., LSP  
Vice President

ISG:cc

N:\04516\GEI Indoor Air Sampling Notice\_Mar2.DOC

March 2, 2006  
Project 04516-0



Mr. Nilson Dasilva  
23 Tufts Street  
Somerville, MA 02145

Dear Mr. Dasilva:

**Re: Indoor Air Sampling**  
**23 Tufts Street**  
**Somerville, Massachusetts**

In 2005, the Massachusetts Department of Environmental Protection (DEP) contacted you and made arrangements to conduct indoor air testing for tetrachloroethylene (PCE) and other compounds in your home. DEP provided you with a letter summarizing the results of its testing, reporting that any PCE detected in your home was below DEP's "threshold limit" for "significant risk of harm to health over a short period of time" and "below the levels DEP typically finds in homes."

DEP has requested that additional rounds of air testing be conducted in your home periodically over the course of the next year, using the same sampling and laboratory testing methods, to create a more complete sampling record. Although DEP has identified several "potentially responsible parties" and asked each to cooperate in this effort, only one -- UniFirst Corporation -- has agreed to proceed voluntarily with the work that DEP requested. UniFirst has engaged GEI Consultants, Inc. (GEI), an environmental consulting firm, to conduct the testing.

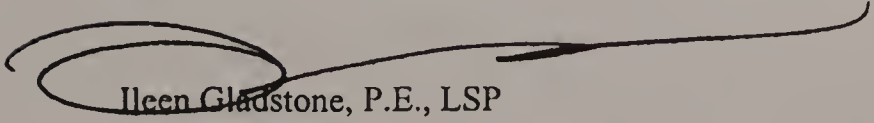
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Sincerely,

GEI CONSULTANTS, INC.



Ilcen Gladstone, P.E., LSP  
Vice President

ISG:cc  
N:\04516\GEI Indoor Air Sampling Notice\_Mar2.DOC



March 2, 2006  
Project 04516-0

Geotechnical  
Environmental and  
Water Resources  
Engineering

Mr. John Boveri  
25 Tufts Street  
Somerville, MA 02145

Dear Mr. John Boveri:

**Re: Indoor Air Sampling  
25 Tufts Street  
Somerville, Massachusetts**

In 2005, the Massachusetts Department of Environmental Protection (DEP) contacted you and made arrangements to conduct indoor air testing for tetrachloroethylene (PCE) and other compounds in your home. DEP provided you with a letter summarizing the results of its testing, reporting that any PCE detected in your home was below DEP's "threshold limit" for "significant risk of harm to health over a short period of time" and "below the levels DEP typically finds in homes."

DEP has requested that additional rounds of air testing be conducted in your home periodically over the course of the next year, using the same sampling and laboratory testing methods, to create a more complete sampling record. Although DEP has identified several "potentially responsible parties" and asked each to cooperate in this effort, only one – UniFirst Corporation – has agreed to proceed voluntarily with the work that DEP requested. UniFirst has engaged GEI Consultants, Inc. (GEI), an environmental consulting firm, to conduct the testing.

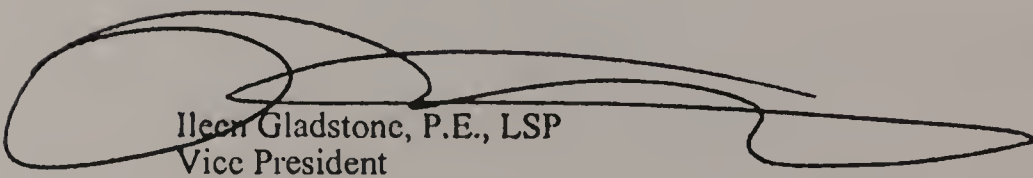
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Sincerely,

GEI CONSULTANTS, INC.



Iileen Gladstone, P.E., LSP  
Vice President

ISG:cc

N:\04516\GEI Indoor Air Sampling Notice\_Mar2.DOC



March 2, 2006  
Project 04516-0

Mr. & Mrs. Papa  
27 Tufts Street  
Somerville, MA 02145

Dear Mr. & Mrs. Papa:

**Re: Indoor Air Sampling  
27 Tufts Street  
Somerville, Massachusetts**

In 2005, the Massachusetts Department of Environmental Protection (DEP) contacted you and made arrangements to conduct indoor air testing for tetrachloroethylene (PCE) and other compounds in your home. DEP provided you with a letter summarizing the results of its testing, reporting that "no detectable contamination was found".

DEP has requested that additional rounds of air testing be conducted in your home periodically over the course of the next year, using the same sampling and laboratory testing methods, to create a more complete sampling record. Although DEP has identified several "potentially responsible parties" and asked each to cooperate in this effort, only one – UniFirst Corporation – has agreed to proceed voluntarily with the work that DEP requested. UniFirst has engaged GEI Consultants, Inc. (GEI), an environmental consulting firm, to conduct the testing.

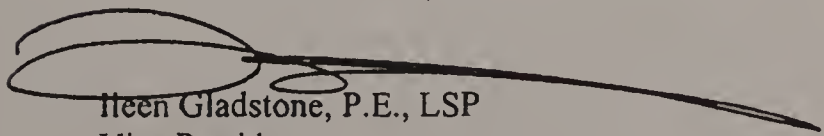
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Sincerely,

GEI CONSULTANTS, INC.



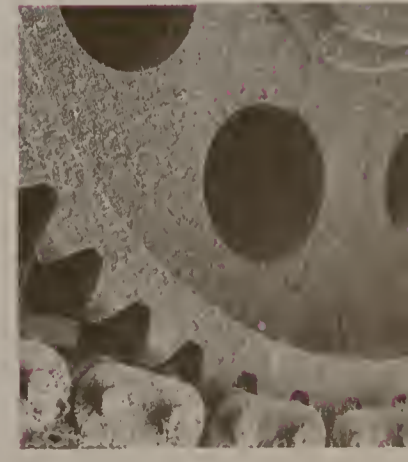
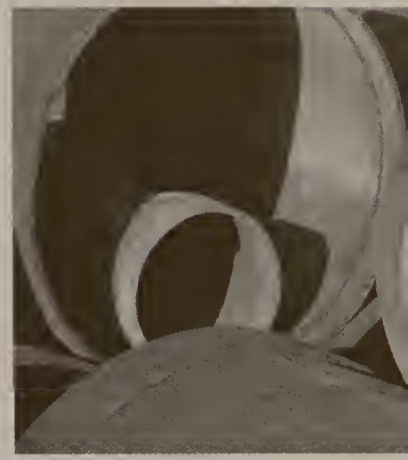
Helen Gladstone, P.E., LSP  
Vice President

ISG:cc  
N:\04516\GEI Indoor Air Sampling Notice\_Mar2.DOC





Geotechnical  
Environmental and  
Water Resources  
Engineering





## Appendix C

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### Air Sampling Work Plan





Geotechnical  
Environmental and  
Water Resources  
Engineering

RTNs 3-23246, 3-24358, and 3-24376

## **Work Plan – Indoor Air Testing**

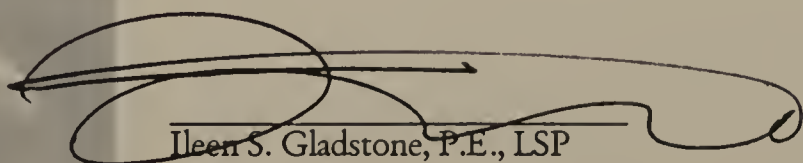
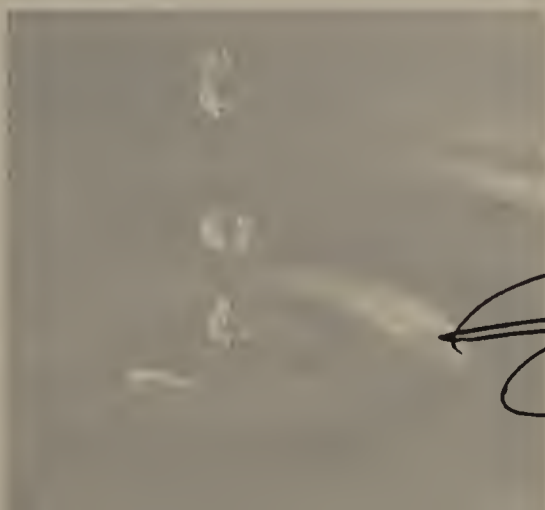
Tufts Street, Somerville, MA

Submitted to:  
UniFirst Corporation  
68 Jonspin Road  
Wilmington, MA 01887

Submitted by:  
GEI Consultants, Inc.  
1021 Main Street  
Winchester, MA 01890  
781.721.4000

March 8, 2006

Project 04516-0



Ileen S. Gladstone, P.E., LSP  
Vice President



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2. Property Owner Information

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- A. Health and Safety Plan
- B. DEP Indoor Air Screening/Sampling Forms for 9, 11/13, 19, 25, 27 Tufts Street, dated February 8 and 9, 2005
- C. GEI SOP SA-009 “Air Sampling Using SUMMA Canisters,” dated 2/20/06



# 1. Introduction

---

The Work Plan was prepared by GEI Consultants, Inc. (GEI) for quarterly and semiannual indoor air sampling at selected residences on Tufts Street and at 50 Tufts Street in Somerville, Massachusetts (Fig. 1). The Work Plan is based on the Immediate Response Action (IRA) Plan for 50 Tufts Street submitted by GEI on behalf of the UniFirst Corporation, to the Massachusetts Department of Environmental Protection (DEP) on January 9, 2006. The Work Plan will be conducted in accordance with the Quality Assurance Project Plan (QAPP) dated March 8, 2006, which was prepared for this project by GEI.

Previous indoor air testing by DEP in February 2005 detected low levels of chlorinated volatile organic compounds (VOCs) at 17 and 19 Tufts Street (Fig. 2). The chlorinated VOCs may be related to the property at 50 Tufts Street where chlorinated VOCs were stored and distributed. Elevated concentrations of chlorinated VOCs were detected in groundwater beneath portions of the 50 Tufts Street property, and in groundwater collected from several monitoring wells located along Tufts Street.



## **2. Air Sampling Work Plan**

---

### **2.1 Pre-Sampling Survey**

Between 24 to 48 hours prior to starting air sampling, GEI will conduct a pre-monitoring inventory and survey of each residence, as well as of 50 Tufts Street, to identify VOC-containing materials and to the extent possible assist the resident in removing them from the residence. GEI's Pre-Sampling Field Checklist for indoor/outdoor air monitoring will be completed for each sampling location. A copy of the checklist is in Appendix C.

As part of the pre-monitoring inventory and survey, the selected residences on Tufts Street and 50 Tufts Street will be screened for the presence of VOCs using a photoionization detector (PID). The PID will be calibrated in accordance with the manufacturer's instructions as described in Section 10 of the QAPP.

Prior to collecting indoor air samples in February 2005, DEP conducted a pre-monitoring inventory at each residence. Copies of the DEP's Indoor Air Screen/Sampling Forms are in Appendix B.

### **2.2 Air Sampling**

Air samples will be collected at both indoor and outdoor locations along Tufts Street. Indoor air samples will be collected from the basement and first floor at seven residences (14 locations), 50 Tufts Street (2 locations), and at two outdoor locations, which are identified in Table 1 and shown in Figure 2. In accordance with the IRA Plan residential air sampling will be conducted on a periodic basis for one year.

Air samples will be collected in accordance with GEI's Standard Operating Procedure (SOP) SA-009, "Air Sampling Using SUMMA Canisters," revised January 31, 2006. The SOP is in Appendix C. Air samples will be collected into pre-cleaned and pre-evacuated SUMMA canisters using flow regulators. Each SUMMA canister will be certified as clean by the testing laboratory (Accutest Laboratory of Marlborough, Massachusetts). Each canister will be filled over a 4-hour period to a final canister pressure of between -5.0 inches of mercury and -0.5 inches of mercury.

Sampling will be conducted during meteorological conditions representative of the season. Sampling will not be conducted during a precipitation event or under high wind conditions.



Air samples will be submitted for volatile organic compound analyses via EPA Method TO-15. The chlorinated VOC testing list includes the following 16 analytes:

- Chloroethane
- Chloroform
- Chloromethane
- Carbon Tetrachloride
- 1,1-Dichloroethane
- 1,1-Dichloroethylene
- 1,2-Dichloroethane
- trans-1,2-Dichloroethylene
- cis-1,2-Dichloroethylene
- Methylene Chloride
- 1,1,1-Trichloroethane
- 1,1,2,2-Tetrachloroethane
- 1,1,2-Trichloroethane
- Tetrachloroethylene
- Trichloroethylene
- Vinyl Chloride

## 2.3 Indoor Air Sampling

Indoor air samples will be collected at the specific locations and heights above the floor/ground surface indicated in Table 2. These locations and heights are consistent with locations and heights of previous air sampling conducted by DEP. Temperature will be measured at each indoor sampling location using a digital thermometer.

Air samples will be submitted to Accutest Laboratories of Marlborough, Massachusetts (Accutest), for VOC testing by method TO-15

The first round of indoor air testing will be conducted in March 2006, with three subsequent quartering sampling rounds at selected residences. These rounds may be modified as additional indoor air, soil and groundwater sampling data is collected.

### 2.3.1 *Collection and Laboratory Analysis – Round 1 (March 2006)*

GEI will collect two indoor air samples from each of the residences located at 9, 11/13, 17, 19, 23, 25, and 27 Tufts Street in March 2006. One sample will be collected from the basement and one sample from the first floor living area at each residence. GEI will also collect two indoor air samples from 50 Tufts Street. One sample will be collected from the office area and one sample from the central portion of the warehouse.

### 2.3.2 *Collection and Laboratory Analysis – Round 2 (May 2006)*

GEI will collect two indoor air samples from each of the residences located at 17 and 19 Tufts Street in May 2006. One sample will be collected from the basement and one sample from the first floor living area at each residence.



### **2.3.3 Collection and Laboratory Analysis – Round 3 (August 2006)**

GEI will collect two indoor air samples from each of the residences located at 9, 11/13, 17, 19, 23, 25, and 27 Tufts Street in August 2006. One sample will be collected from the basement and one sample from the first floor living area at each residence. Samples will be submitted to Accutest for VOC testing by method TO-15.

### **2.3.4 Collection and Laboratory Analysis – Round 4 (November 2006)**

GEI will collect two indoor air samples from each of the residences located at 17 and 19 Tufts Street in November 2006. One sample will be collected from the basement and one sample from the first floor living area at each residence.

## **2.4 Outdoor Air Sampling**

GEI will collect two outdoor ambient air samples during each round of indoor air sampling to evaluate the potential presence of VOCs in ambient outdoor air. One external air sample will be collected upwind of the currently identified disposal site, and not within the areal extent of known VOC-contaminated groundwater. A second outdoor air sample will be located between 17 and 19 Tufts Street, which is proximate to the existing groundwater observation well GEO-4 where elevated levels of VOCs have been detected in groundwater. Locations for outdoor air sampling are identified in Figure 2, but may be adjusted according to wind direction on the day of sampling and to maximize the distance between the sampling location and vehicular traffic. Outdoor samples will be secured to a stationary object near the sampling location (such as a fence) with a lock and chain. The sampling location will be marked with traffic cones and flagging to prevent pedestrian disturbance of the sample. GEI personnel will monitor the sampling location throughout the collection period.

Measurement of outdoor wind direction, barometric pressure, and temperature will be made using a portable weather station. Values obtained by direct measurement for temperature and barometric pressure will be compared with values published for measurements made at Logan and Hanscom airports.



### 3. Quality Assurance / Quality Control

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Quality assurance and quality control (QA/QC) procedures will be followed throughout the air sampling program to ensure the collection and analysis of representative air monitoring data. The QA/QC procedures cover sample collection, sample preservation, sample transport, laboratory handling and analysis, and data validation. The QA/QC procedures are described in detail in the project specific QAPP, which is on file at GEI's Winchester, Massachusetts, office.

During Round 1 and Round 3 of sampling two field duplicates will be collected. During Round 2 and Round 4 one field duplicate will be collected. The duplicates will be obtained by using a splitter attached to the SUMMA canisters' air intakes. The duplicate samples will be submitted to the laboratory "blind" (i.e. the laboratory will not be informed that the sample is a duplicate sample).

For each round of sampling one trip blank will be submitted for laboratory analysis to demonstrate that VOC contamination of the sampling vessels did not occur during the transport of the canisters both to and from the sampling site, and the laboratory. The trip blanks will consist of laboratory-prepared, evacuated SUMMA canisters that will be transported with the SUMMA canisters that will be used to sample indoor air at the site. The trip blank will remain on-site during sampling, and then will be returned to the laboratory with the SUMMA canisters containing the indoor air samples. The trip blank SUMMA canister will be partially filled with inert clean gas upon return to the laboratory and then analyzed for VOCs using the TO-15 method.







Table 1

**Indoor Air Sampling Locations and Schedule**  
**Indoor Air Sampling Work Plan**  
**Tufts Street**

Sample Location	Sampling Dates	Sample ID	Sampling Location	Canister Height Above Floor (ft)
<b>Indoor Air Sampling</b>				
9 Tufts Street	March, August 2006	045160-9Tufts-B	Basement	3 to 5 feet
		045160-9Tufts-1	First floor (kitchen)	3 to 5 feet
11/13 Tufts Street	March, August 2006	045160-11/13Tufts-B	Basement	3 to 5 feet
		045160-11/13Tufts-1	First floor (kitchen)	3 to 5 feet
		045160-17Tufts-B	Basement	3 to 5 feet
17 Tufts Street	March, May, August, November 2006	045160-17Tufts-1	First floor (living room)	3 to 5 feet
		045160-17Tufts-C	Basement (Duplicate)	3 to 5 feet
19 Tufts Street	March, August 2006	045160-19Tufts-B	Basement	3 to 5 feet
		045160-19Tufts-1	First floor (living room)	3 to 5 feet
23 Tufts Street	March, August 2006	045160-19Tufts-C	Basement (Duplicate)	3 to 5 feet
		045160-23Tufts-B	Basement	3 to 5 feet
25 Tufts Street	March, August 2006	045160-23Tufts-1	First floor (living room)	3 to 5 feet
		045160-25Tufts-B	Basement	3 to 5 feet
27 Tufts Street	March, August 2006	045160-27Tufts-B	Basement	3 to 5 feet
		045160-27Tufts-1	First floor (living room)	3 to 5 feet
50 Tufts Street	March 2006	045160-50Tufts-Off	Office area	3 to 5 feet
		045160-50Tufts-Ware	Warehouse area	3 to 5 feet
<b>Outdoor Air Sampling</b>				
Near the intersection of Tufts and Washington Streets	March, May, August, November 2006	045160-Tufts-O-1	Outdoors	Approximately 3 to 5 feet above ground surface
Near 17 Tufts Street	March, May, August, November 2006	045160-Tufts-O-2	Outdoors	Approximately 3 to 5 feet above ground surface

**General Notes:**

1. Canisters will be placed at the same approximate height as during the DEP sampling round, this height will be confirmed with DEP



Table 2

**Property Owner Information  
Indoor Air Sampling Work Plan  
Tufts Street**

Sample Location	Sample Location Owner	Town	Owner Agreed Sample Date and Time	Owner Phone Number(s)	Notes (Building Description, Access Conditions, Owner Requests)
9 Tufts Street	Avani Campos P.O. Box 423, Somerville, MA 02143	Somerville	<i>To be determined</i>	(617) 501 6806	3 stories, 6 residential apartment units, 9 bedrooms, gas heat, built 1880
11/13 Tufts Street	Delores Devellis	Somerville	<i>To be determined</i>	(617) 628 5238	3 stories, 3 residential apartment units, 6 bedrooms, oil heat, built 1900
17 Tufts Street	Remy & Helene Prevost	Somerville	<i>To be determined</i>	(617) 625-0843	2.5 stories, 2 family, 5 bedrooms, oil heat, built 1900
19 Tufts Street	Gerald Laurentano	Somerville	<i>To be determined</i>	(617) 625-3469 cell (857) 222-4620	2.5 stories, 2 family, 4 bedrooms, gas heat, built 1900
23 Tufts Street	Nilson Dasilva	Somerville	<i>To be determined</i>	(617) 224-8543 (617) 666-6633	1 story, 1 family, 3 bedrooms, gas heat, built 1991
25 Tufts Street	John Boveni	Somerville	<i>To be determined</i>	(617) 625-2468	2.75 stories, 2 family, 5 bedrooms, oil heat, built 1900
27 Tufts Street	Janice & Richard Papa	Somerville	<i>To be determined</i>	(617) 625-7256	2.5 stories, 2 family, 4 bedrooms, coal/wood heat, built 1900
50 Tufts Street	Somerville Two, LLC	Somerville	<i>To be determined</i>	--	Single story industrial warehouse, forced hot air heating (gas), masonry construction

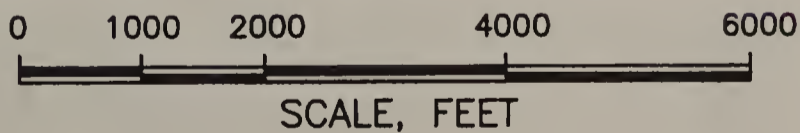
**General Notes:**

1. Information on building structure is from the City of Somerville's Assessor's Office.









This Image provided by MassGIS is taken from  
 U.S.G.S. Topographic 7.5 X 15 Minute Series  
 Boston North, MA Quadrangle, 1985.  
 Datum is National Geodetic Vertical Datum (NGVD).  
 Contour Interval is 3 Meters.



Indoor Air Testing - Work Plan  
 Tufts Street  
 Somerville, Massachusetts

UniFirst Corporation  
 Wilmington, Massachusetts



Project 045160

LOCATION MAP

March 2006

Fig. 1



# LEGEND

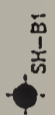
Indoor Air Testing Location



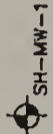
MONITORING WELLS INSTALLED UTILIZING GEOPROBE ADVANCEMENT METHODS BY ENVIRONMENTAL DRILLING, INC. OF STERLING, MASSACHUSETTS ON 6/21/02. BORING AND WELL CONSTRUCTION WERE OBSERVED AND LOGGED BY SHA PERSONNEL



BORINGS ADVANCED UTILIZING GEOPROBE ADVANCEMENT METHODS BY ENVIRONMENTAL DRILLING, INC. OF STERLING, MASSACHUSETTS ON 6/21/02. BORING AND WELL CONSTRUCTION WERE OBSERVED AND LOGGED BY SHA PERSONNEL



MONITORING WELLS INSTALLED UTILIZING 6" ID AUGER ADVANCEMENT METHODS BY ENVIRONMENTAL DRILLING, INC. OF STERLING, MA ON 7/3/02. BORING AND WELL CONSTRUCTION WERE OBSERVED AND LOGGED BY SHA PERSONNEL



PRE-EXISTING MONITORING WELLS FOUND ON SITE BY SHA PERSONNEL



MONITORING WELLS INSTALLED BY GEOINSIGHT PERSONNEL, AUGUST 2004.

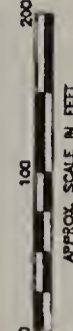


SOIL BORINGS INSTALLED

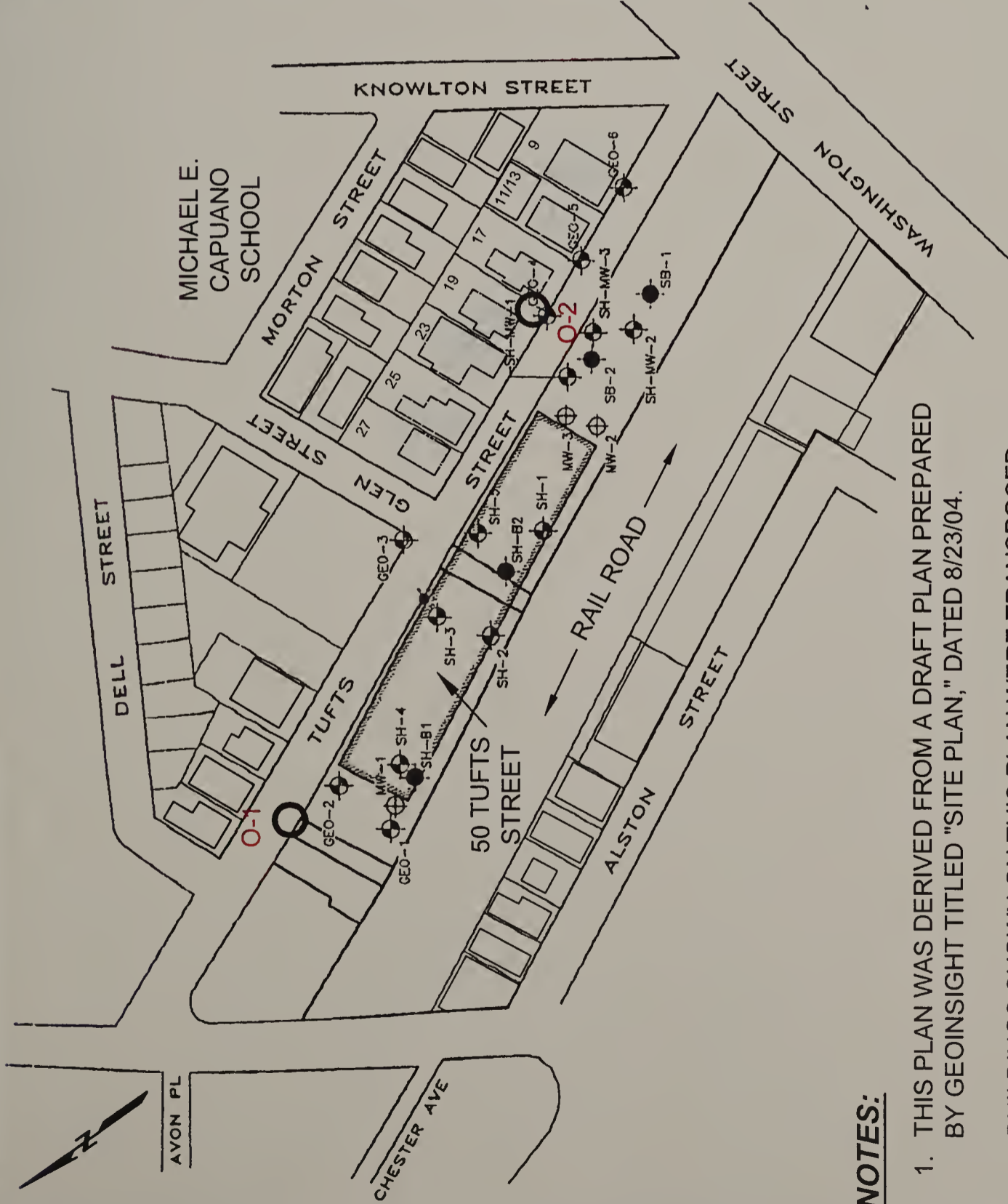


O-1 & O-2

PROPOSED OUTDOOR AIR MONITORING LOCATIONS



APPROX. SCALE IN FEET



## NOTES:

1. THIS PLAN WAS DERIVED FROM A DRAFT PLAN PREPARED BY GEOINSIGHT TITLED "SITE PLAN," DATED 8/23/04.
2. BUILDINGS SHOWN ON THIS PLAN WERE TRANPOSED FROM THE CITY OF SOMERVILLE ASSESSORS MAP NO. 93, DATED JANUARY 3, 2001.

Indoor Air Testing - Work Plan  
Tufts Street  
Somerville, Massachusetts  
UniFirst Corporation  
Wilmington, Massachusetts



Project 045160

March 2006

PROPOSED  
SAMPLING  
LOCATIONS

Fig. 2







# Appendix A

---

## Health and Safety Plan



## **GEI HEALTH AND SAFETY PLAN (HASP)**

**Project Name:** Indoor Air Sampling, Tufts Street

**Project Location:** Tufts Street  
Somerville, MA

### **SITE/ PROJECT DESCRIPTION**

The site has chlorinated solvents present in the soil and groundwater around Tufts Street, and tetrachloroethylene has been detected in indoor air at the residences. GEI will conduct pre-sampling surveys of the residences at 9, 11, 13, 17, 19, 25, and 27 Tufts Street and indoor air sampling at each of the residences. The sampling will be done using seven Summa Canisters in the basement and seven Summa Canisters (also known as TO-15) placed on the first floor of the properties. The Summa Canisters will be positioned to in an effort to collect data that is representative of the air quality throughout the entire floor. If site conditions suggest the existence of a situation more hazardous than anticipated, the site personnel shall evacuate the immediate area. The hazard and the level of protection shall then be reevaluated with the assistance and approval of the Health and Safety Specialist and Project Manager.

**General On-Site Equipment:** First aid kit, drinking water, insect repellent, sunscreen, extra disposable gloves, disposable wash clothes, antibacterial soap, portable phone, traffic cones, and caution tape.

### **POTENTIAL HAZARDS**

The potential hazards for this project have been categorized into site and activity hazards. Site hazards are those hazards associated with site conditions and activity hazards are associated with GEI on-site activities. The potential hazards and control measures established to reduce the risk of injury or illness are identified in the following tables. Safe operating procedures established for routine hazards and common site conditions are included in the table below or contained in the GEI Corporate Health and Safety Manual.

PHYSICAL/BIOLOGICAL HAZARDS AND CONTROL	
Potential Hazard	Control Measures
Heat Stress	<ul style="list-style-type: none"> <li>• Increase water intake while working.</li> <li>• Increase number of rest breaks and/or rotate workers in shorter work shifts. Rest in cool, dry areas.</li> <li>• Watch for signs and symptoms of heat exhaustion and fatigue.</li> <li>• Plan work for early morning or evening during hot months.</li> <li>• Use ice vests when necessary.</li> <li>• In the event of heat stroke, bring the victim to a cool environment and initiate first aid procedures.</li> </ul>
Cold Stress	<ul style="list-style-type: none"> <li>• Take breaks in heated shelters when working in extremely cold temperatures.</li> <li>• Wear loose layered clothing to promote heat convection and absorption of perspiration.</li> <li>• Drink warm liquids to reduce the susceptibility to cold stress.</li> </ul>
Physical Injury	<p>Prevent slips, trips, and falls by:</p> <ul style="list-style-type: none"> <li>• Wearing work boots in good condition with non-slip soles.</li> <li>• Maintaining good visibility of the work area.</li> <li>• Avoiding walking on uneven or debris ridden ground surfaces.</li> </ul>
Back Injury	<ul style="list-style-type: none"> <li>• Use a mechanical lifting device or a lifting aid where appropriate.</li> <li>• If you must lift, plan the lift before doing it.</li> <li>• Check your route for clearance.</li> <li>• Bend at the knees and use leg muscles when lifting.</li> <li>• Use the buddy system when lifting heavy or awkward objects.</li> <li>• Do not twist your body while lifting.</li> </ul>
Vehicular Traffic	<ul style="list-style-type: none"> <li>• Wear traffic safety vest at all times.</li> <li>• Use cones, flags, barricades, and caution tape to define work area.</li> <li>• Use a "spotter" to locate oncoming vehicles.</li> <li>• Use vehicle to block work area.</li> <li>• Engage police detail for all work conducted in appropriate areas.</li> </ul>
Inclement Weather	<ul style="list-style-type: none"> <li>• Stop outdoor work during electrical storms and other extreme weather conditions such as extreme heat or cold temperatures.</li> <li>• Take cover indoors or in vehicle.</li> <li>• Listen to local forecasts for warnings about specific weather hazards such as tornados, hurricanes, and flash floods.</li> </ul>
Unsecured or High Crime Areas	<ul style="list-style-type: none"> <li>• Be aware of your surroundings.</li> <li>• Use the buddy system. Do not remain on site alone. Accompany or be accompanied by others to vehicles.</li> <li>• Request police detail when appropriate.</li> </ul>
Shift Hours & Night Operations	<ul style="list-style-type: none"> <li>• Work shifts shall not be greater than 12 hours.</li> <li>• Driving distance and time after a 12-hour shift shall not exceed 30 miles or 30 minutes (whichever is greater).</li> <li>• Night operations shall include proper lighting, security measures (phone, police detail, guards), sanitary facilities, food and water.</li> </ul>
Insects	<ul style="list-style-type: none"> <li>• Tuck pants into socks.</li> <li>• Wear long sleeves.</li> <li>• Use insect repellent.</li> </ul>
Poisonous Plants (such as poison ivy, oak, or sumac)	<ul style="list-style-type: none"> <li>• Avoid areas infested with poisonous plants.</li> <li>• Immediately wash with soap and water any areas that come into contact with poisonous plants.</li> </ul>

ACTIVITY HAZARDS		
Activity	Potential Hazards	Protective Equipment
Air sampling	vapor inhalation	Not Applicable
Personal protective equipment (PPE) has been initially selected based on activity hazards and site conditions. PPE listed for each activity is the <i>initial level of protection <u>to be worn</u>, and may need to be upgraded if conditions change.</i>		

## AIR MONITORING

Air monitoring will be conducted to identify the levels of airborne substances in the work area. The results from air monitoring provide basis for a work area evacuation or an increase in the degree of respiratory protection. Air monitoring for organic vapor concentration will be conducted using a Thermo 580B photoionization detector (PID) calibrated to isobutylene, and **using a response factor for tetrachloroethylene of 1.9.** Summa Canisters will be used to collect air samples. The Summa Canisters will collect a sample for four hours and will be evaluated for Volatile Organic Compounds (VOC's) by laboratory analysis (EPA method TO-15). A copy of the NIOSH Pocket Guide to Chemical Hazards for PCE is attached.

The following table identifies the compounds that are to be monitored, their associated action levels, and the contingency measures to be taken if action levels are exceeded.

REQUIRED MONITORING AND ACTION LEVELS			
Contaminant	Equipment	Action Level	Contingency if Action Level Exceeded
VOCs (Tetrachloroethylene = PCE)	PID and Draeger Tubes	Greater than 2 ppm*  Check for the presence of PCE	Check for PCE using Draeger – call PM if >2 ppm PCE
* action level shall be based on sustained readings in the breathing zone of greater than 5 minutes.			

## **SITE CONTROL**

**Buddy System:** If practical, GEI personnel should utilize the “buddy system,” and be in line-of-site or communication contact with another GEI employee while on-site. The GEI on-site personnel should be aware of their role as a "buddy" and be able to provide assistance in the event of an emergency.

## **SITE PERSONNEL**

**Project Manager:** The Project Manager has the overall responsibility for the safety of operations and health and safety of all project personnel.

**Health and Safety Specialist:** The Health and Safety Specialist is responsible for evaluating the project operations and identifying procedures to reduce the risk of injury and illness of project personnel. The Health and Safety Specialist shall be a resource to the project staff and shall be consulted on all related health and safety issues that arise in the field, including any changes in the scope of work.

**Project Staff:** GEI personnel are responsible for the health and safety of themselves and other GEI project personnel and must adhere to the procedures established in this plan. Personnel shall maintain an awareness of site conditions and exercise good judgment when confronted with hazardous or unsafe conditions. If the safety procedures identified in this plan do not address the hazardous or unsafe condition, then personnel shall follow the safest course of action and seek the advice of a GEI Health and Safety Specialist.

**Training Requirements:** GEI personnel conducting the site work shall have completed an initial 40 hours of classroom-style health and safety training and three days of on-site training, as required by OSHA 29 CFR 1910.120. In addition, on-site supervisors shall receive an additional eight hours of supervisory training. GEI employees shall receive a minimum of eight hours of refresher training annually. A pre-entry briefing, given by the Project Manager and/or the Corporate Health and Safety Specialist, will serve to familiarize on-site personnel with the procedures, requirements, and provisions of this HASP. In addition, GEI personnel shall sign the plan to document that they understand the hazards and control measures presented and agree to comply with the procedures established in the HASP.

**Medical Surveillance Requirements:** Participation in the medical surveillance program is required for all GEI personnel conducting activities on site. The medical surveillance program is in compliance with the provisions set forth in OSHA 29 CFR 1910.120, and other applicable federal and state regulations. Medical surveillance requirements are outlined in the GEI Corporate Health and Safety Manual and have been reviewed by a Board-Certified Occupational Physician.

## Site Emergency Contingency Plans

The following table outlines the actions to be taken for specific emergency situations, emergency phone numbers, and directions to the local hospital:

<b>CONTINGENCY PLANS FOR SITE EMERGENCIES</b>	
<b>Situation</b>	<b>Action</b>
Evacuation	<ul style="list-style-type: none"> <li>• Notify on-site personnel of an emergency requiring evacuation.</li> <li>• Leave the dangerous area and report to a designated rally point.</li> <li>• Notify Emergency Services, as appropriate. Account for known personnel.</li> <li>• Contact the PM soon as possible.</li> <li>• Maintain site security and control measures for community safety until emergency responders arrive.</li> </ul>
Medical Emergency	<ol style="list-style-type: none"> <li>1. Only perform assistance that does not jeopardize your safety. <ul style="list-style-type: none"> <li>• Establish the patient's level of consciousness.</li> <li>• Contact Emergency Medical Services and inform them of patient's condition.</li> <li>• Call for help.</li> </ul> </li> <li>2. While awaiting EMS perform first aid to the level of your training. <ul style="list-style-type: none"> <li>• Check conscious level.</li> <li>• Open airway.</li> <li>• Check breathing.</li> <li>• Check circulation.</li> <li>• Check for bleeding: control with direct pressure.</li> <li>• Do not move patient (unless location is not secure).</li> <li>• Remain with the patient until EMS arrives.</li> <li>• Contact the PM and Health &amp; Safety as soon as possible.</li> <li>• Document the incident on GEI Accident/Incident form.</li> </ul> </li> </ol>
Fire Emergency	<ol style="list-style-type: none"> <li>1. Evacuate the area.</li> <li>2. Notify the Emergency Services.</li> <li>3. Extinguish small contained fires.</li> <li>4. Contact the PM and Health and Safety.</li> <li>5. Document the incident using the Accident/Incident Form.</li> </ol>

Important Phone Numbers		Directions to Hospital
Local Police 221 Washington Street	911 (617) 625-1600	1) Start out going NW on Tufts Street toward Dell St 2) Turn left on Cross Street 3) Turn right onto McGrath Highway 4) McGrath Highway becomes Medford Street 5) Turn slight left onto Highland Avenue 6) End at 230 Highland Avenue Somerville Hospital 230 Highland Avenue Somerville, MA Emergency Room open 24-hours
Fire Department 266 Broadway	911 (617) 623-1700	
Ambulance	911	
County Sheriff or State Police	(617) 455-5600	
Somerville Hospital	(671) 591-4500	
Corporate Health & Safety Officer Robin DeHate	(813) 910-3104 (office) (813) 323-6220 (mobile)	
Project Manager / Safety Specialist Mark C. Ensign, P.G.	(781) 721-4010 (office) (781) 789-9789 (mobile) (978) 579-6995 (home)	
Client Contact (UniFirst) Stephen Aquilino	(978) 658-8888 x 649	
Nearest Telephone Location:		Cellular phone



Once the site-specific health and safety form has been read, complete this sign-off sheet and return it to GEI Corporate Health and Safety.

**SAFETY PLAN SIGN-OFF**

**GEI personnel conducting site activities shall be familiar with the requirements of this plan and agree to its implementation.**

Site Name: Tufts Street, Somerville, MA Project No: 045160

Name: \_\_\_\_\_ Signature: \_\_\_\_\_

Name: \_\_\_\_\_ Signature: \_\_\_\_\_

Name: \_\_\_\_\_ Signature: \_\_\_\_\_

Name: \_\_\_\_\_ Signature: \_\_\_\_\_

Name: \_\_\_\_\_ Signature: \_\_\_\_\_

Name: \_\_\_\_\_ Signature: \_\_\_\_\_

Safety Specialist: \_\_\_\_\_

Project Manager: \_\_\_\_\_


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Occupational Safety and Health*
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[Databases and Information Resources](#)
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NIOSH Publication No. 2005-151:

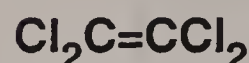
September

# NIOSH Pocket Guide to Chemical Hazards

[NPG Home](#) | [Introduction](#) | [Synonyms & Trade Names](#) | [Chemical Names](#) | [CAS Numbers](#) | [RTECS Numbers](#) | [Appendix A Search](#)

## Tetrachloroethylene

CAS 127-18-4


RTECS [KX3850000](#)

### Synonyms & Trade Names

Perchloroethylene, Perchloroethylene, Perk, Tetrachlorethylene

DOT ID &amp; Guide

1897 [160](#)

### Exposure Limits

NIOSH REL: Ca Minimize workplace exposure concentrations. [See Appendix A](#)

OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in an hours)

IDLH Ca [150 ppm] See: [127184](#)

Conversion 1 ppm = 6.78 mg/m<sup>3</sup>

### Physical Description

Colorless liquid with a mild, chloroform-like odor.

MW: 165.8

BP: 250°F

FRZ: -2°F

Sol: 0.02%

VP: 14 mmHg

IP: 9.32 eV

Sp.Gr: 1.62

FI.P: NA

UEL: NA

LEL: NA

Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.

### Incompatibilities & Reactivities

Strong oxidizers; chemically-active metals such as lithium, beryllium &amp; barium; caustic soda; sodium hydroxide; potash

### Measurement Methods

NIOSH [1003](#); OSHA [1001](#)

See: [NMAM](#) or [OSHA Methods](#)

### Personal Protection & Sanitation (See [protection](#))

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet or contaminated

Change: No recommendation

Provide: Eyewash, Quick drench

### First Aid (See [procedures](#))

Eye: Irrigate immediately

Skin: Soap wash promptly

Breathing: Respiratory support

Swallow: Medical attention immediately

### Respirator Recommendations NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or ot positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted orga vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]

**Target Organs** Eyes, skin, respiratory system, liver, kidneys, central nervous system

**Cancer Site** [in animals: liver tumors]

See also: INTRODUCTION See ICSC CARD: 0076 See MEDICAL TESTS: 0179

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## Appendix B

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**DEP Indoor Air Screening/Sampling Forms for 9, 11/13, 19, 25,  
27 Tufts Street, from February 8 and 9, 2005**





MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION  
Northeast Regional Office/Bureau of Waste Site Cleanup  
**INDOOR AIR SCREENING/SAMPLING FORM**

RELEASE TRACKING NUMBER

3- 24376

TOWN  
Somerville

Address: 9 Tufts St. Name/Identifier: Campos Avani

**BUILDING INFORMATION (check all that apply)**

Type of Building: ☒ Residential ☐ Commercial ☐ Industrial ☐ Mixed ☐ Other: Co apt  
Foundation Type: ☐ Finished Basement ☒ Full Basement ☐ Partial Basement/Crawl Space ☐ Slab-on-Grade  
Foundation Material(s): ☒ Fieldstone ☐ Concrete Block ☐ Poured Concrete ☐ Other: brick  
Foundation Integrity: ☐ No Cracks/Open Joints ☒ Moderate Cracks/Open Joints ☐ Many Cracks/Open Joints  
Basement/Slab Floor: ☐ Concrete/Good Integrity ☐ Concrete with Cracks ☐ Earthen Floor ☐ Carpet/Flooring  
Basement Use: ☒ Storage/Infrequent Use ☐ Recreation/Living Space ☐ Bedrooms ☐ Other:  
Drainage Sump Present: ☐ No ☐ Yes Standing Water in Sump? ☒ No ☐ Yes Product in Sump? ☒ No ☐ Yes  
Ducted Heating/Cooling (HVAC) System? ☐ No ☐ Yes HVAC Air Intake in Basement? ☐ No ☐ Yes  
Open windows in sampling area(s)? ☒ No ☐ Yes Odors in basement/building? ☐ No ☒ Yes (describe below)  
Comments: private well - not being used musty/pet. U.O. lacquer thinner

**USE/STORAGE OF OIL OR HAZARDOUS MATERIALS**

Oil Tank in Basement/Building? ☐ No ☐ Yes: Oil odor near tank? ☐ None ☐ Weak ☐ Strong ( ppmv)  
Gasoline Storage in Basement/Building (e.g., lawn mowers, 5 gallon containers)? ☐ No ☐ Yes  
Other OHMs observed: ☐ Paints/Stains ☐ Cleaning Solvents ☐ New Building Materials ☐ Other:  
Comments/Description: forced hot air

**PID SCREENING OF CRACKS/ANNULUS SPACES**

PID screening of annulus space around utilities pipes through basement wall/floor? ☒ Yes ☐ No ☐ Not Accessible  
PID screening of cracks in wall/floor and/or wall/floor interfaces? ☒ Yes ☐ No ☐ Not Accessible ☐ No Cracks  
PID screening of space above drain sump? ☐ Not Applicable ☐ Not Accessible ☒ Yes ☐ No  
Results of Screening/Comments: U.O.

**SAMPLE COLLECTION INFORMATION**

Sample ID:	Location	Time	Date	PID PPMV
9-B	basement	12:15	2/9/05	U.O.
9-1	Kitchen	12:00	2/9/05	0.0/0.1

**SAMPLING PROCEDURE:** ☐ (1) Run PID pump for at least 60 seconds to purge. (2) With tube on outlet, direct discharge into an inverted 40 mL vial. (3) Sample for 30-60 seconds. (4) Slowly withdraw tube from vial while PID pump running. (4) Tightly cap vial, label, and store in dark (DO NOT COOL/REFRIGERATE). ☐ Other procedure used (describe on back of form)  
Samples Collected By: Irene Dae Comments on Back: ☐ No ☐ Yes



MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION  
Northeast Regional Office/Bureau of Waste Site Cleanup  
INDOOR AIR SCREENING/SAMPLING FORM

RELEASE TRACKING NUMBER

3- 24376

TOWN

Somerville

Address:

11-13 Tufts St.

Name/Identifier:

Dores Develis

**BUILDING INFORMATION (check all that apply)**

Type of Building: ☒ Residential ☐ Commercial ☐ Industrial ☐ Mixed ☐ Other: 3  
Foundation Type: ☐ Finished Basement ☒ Full Basement ☐ Partial Basement/Crawl Space ☐ Slab-on-Grade  
Foundation Material(s): ☒ Fieldstone ☐ Concrete Block ☐ Poured Concrete ☐ Other: \_\_\_\_\_  
Foundation Integrity: ☐ No Cracks/Open Joints ☐ Moderate Cracks/Open Joints ☐ Many Cracks/Open Joints  
Basement/Slab Floor: ☐ Concrete/Good Integrity ☒ Concrete with Cracks ☐ Earthen Floor ☐ Carpet/Flooring  
Basement Use: ☒ Storage/Infrequent Use ☐ Recreation/Living Space ☐ Bedrooms ☐ Other: \_\_\_\_\_  
Drainage Sump Present: ☐ No ☐ Yes Standing Water in Sump? ☐ No ☐ Yes Product in Sump? ☐ No ☐ Yes  
Ducted Heating/Cooling (HVAC) System? ☐ No ☒ Yes HVAC Air Intake in Basement? ☐ No ☐ Yes  
Open windows in sampling area(s)? ☒ No ☐ Yes Odors in basement/building? ☐ No ☐ Yes (describe below)  
Comments:

**USE/STORAGE OF OIL OR HAZARDOUS MATERIAL**

Oil Tank in Basement/Building? ☐ No ☒ Yes: 3 Oil odor near tank? ☐ None ☒ Weak ☐ Strong (\_\_\_\_ ppmv)  
Gasoline Storage in Basement/Building (e.g., lawn mowers, 5 gallon containers)? ☐ No ☐ Yes  
Other OHMs observed: ☐ Paints/Stains ☐ Cleaning Solvents ☐ New Building Materials ☐ Other: \_\_\_\_\_  
Comments/Description: forced hot water

**PID SCREENING OF CRACKS/ANNULUS SPACES**

PID screening of annulus space around utilities pipes through basement wall/floor? ☒ Yes ☐ No ☐ Not Accessible  
PID screening of cracks in wall/floor and/or wall/floor interfaces? ☒ Yes ☐ No ☐ Not Accessible ☐ No Cracks  
PID screening of space above drain sump? ☒ Not Applicable ☐ Not Accessible ☐ Yes ☐ No  
Results of Screening/Comments:

**SAMPLE COLLECTION INFORMATION**

Sample ID:	Location	Time	Date	PID PPMV
11-1	kitchen	1:08	2/9/05	0/0.1
11-B	basement	1:15	2/9/05	0/0.1

SAMPLING PROCEDURE: ☐ (1) Run PID pump for at least 60 seconds to purge. (2) With tube on outlet, direct discharge into an inverted 40 mL vial. (3) Sample for 30-60 seconds. (4) Slowly withdraw tube from vial while PID pump running. (4) Tightly cap vial, label, and store in dark (DO NOT COOL/REFRIGERATE). ☐ Other procedure used (describe on back of form)

Samples Collected By: Dore Develis

Comments on Back: ☐ No ☐ Yes



MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION  
Northeast Regional Office/Bureau of Waste Site Cleanup  
**INDOOR AIR SCREENING/SAMPLING FORM**

RELEASE TRACKING NUMBER

3-

24376

TOWN

Somerville

Address:

19 Tufts St.

Name/Identifier:

Gerald Laurentano

**BUILDING INFORMATION (check all that apply)**

Type of Building: ☒ Residential ☐ Commercial ☐ Industrial ☐ Mixed ☐ Other: \_\_\_\_\_  
Foundation Type: ☐ Finished Basement ☒ Full Basement ☐ Partial Basement/Crawl Space ☐ Slab-on-Grade  
Foundation Material(s): ☒ Fieldstone ☐ Concrete Block ☐ Poured Concrete ☐ Other: brick  
Foundation Integrity: ☐ No Cracks/Open Joints ☐ Moderate Cracks/Open Joints ☐ Many Cracks/Open Joints  
Basement/Slab Floor: ☐ Concrete/Good Integrity ☒ Concrete with Cracks ☐ Earthen Floor ☐ Carpet/Flooring  
Basement Use: ☒ Storage/Infrequent Use ☐ Recreation/Living Space ☐ Bedrooms ☐ Other: \_\_\_\_\_  
Drainage Sump Present: ☐ No ☐ Yes Standing Water in Sump? ☐ No ☐ Yes Product in Sump? ☒ No ☐ Yes  
Ducted Heating/Cooling (HVAC) System? ☒ No ☐ Yes HVAC Air Intake in Basement? ☐ No ☐ Yes  
Open windows in sampling area(s)? ☒ No ☐ Yes Odors in basement/building? ☐ No ☐ Yes (describe below)  
Comments: near cleanout - 0.5 PID  
ac

**USE STORAGE OF OIL OR HAZARDOUS MATERIALS**

Oil Tank in Basement/Building? ☐ No ☐ Yes: Oil odor near tank? ☐ None ☐ Weak ☐ Strong (\_\_\_\_ ppmv)  
Gasoline Storage in Basement/Building (e.g., lawn mowers, 5 gallon containers)? ☐ No ☐ Yes  
Other OHMs observed: ☒ Paints/Stains ☐ Cleaning Solvents ☐ New Building Materials ☐ Other: \_\_\_\_\_  
Comments/Description: paints - latex  
mineral spirits

**PID SCREENING OF CRACKS/ANNULUS SPACES**

PID screening of annulus space around utilities pipes through basement wall/floor? ☐ Yes ☐ No ☐ Not Accessible  
PID screening of cracks in wall/floor and/or wall/floor interfaces? ☐ Yes ☐ No ☐ Not Accessible ☐ No Cracks  
PID screening of space above drain sump? ☐ Not Applicable ☐ Not Accessible ☐ Yes ☐ No  
Results of Screening/Comments: cleanout - 0.5 PID  
gets water fr bad  
near main line 0.3 PID

**SAMPLE COLLECTION INFORMATION**

Sample ID:	Location	Time	Date	PID PPMV
19-B	19 Tufts Basement	12:40	2/9/05	0.5 max
19-1	19 Tufts St 1st Floor	12:30	2/9/05	0.2-0.3

**SAMPLING PROCEDURE:** ☐ (1) Run PID pump for at least 60 seconds to purge. (2) With tube on outlet, direct discharge into an inverted 40 mL vial. (3) Sample for 30-60 seconds. (4) Slowly withdraw tube from vial while PID pump running. (4) Tightly cap vial, label, and store in dark (DO NOT COOL/REFRIGERATE). ☐ Other procedure used (describe on back of form)

Samples Collected By: Dore Dole

Comments on Back: ☐ No ☐ Yes



MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION  
Northeast Regional Office/Bureau of Waste Site Cleanup  
INDOOR AIR SCREENING/SAMPLING FORM

RELEASE TRACKING NUMBER

3- 24376

TOWN

Somerville

Address:

25 Tufts St.

Name/Identifier:

Lee Boveri

BUILDING INFORMATION (check all that apply)

Type of Building: ☒ Residential ☐ Commercial ☐ Industrial ☐ Mixed ☐ Other: \_\_\_\_\_  
Foundation Type: ☐ Finished Basement ☒ Full Basement ☐ Partial Basement/Crawl Space ☐ Slab-on-Grade  
Foundation Material(s): ☒ Fieldstone ☐ Concrete Block ☐ Poured Concrete ☐ Other: \_\_\_\_\_  
Foundation Integrity: ☐ No Cracks/Open Joints ☒ Moderate Cracks/Open Joints ☐ Many Cracks/Open Joints  
Basement/Slab Floor: ☐ Concrete/Good Integrity ☒ Concrete with Cracks ☐ Earthen Floor ☐ Carpet/Flooring  
Basement Use: ☒ Storage/Infrequent Use ☐ Recreation/Living Space ☐ Bedrooms ☐ Other: \_\_\_\_\_  
Drainage Sump Present: ☐ No ☐ Yes Standing Water in Sump? ☒ No ☐ Yes Product in Sump? ☒ No ☐ Yes  
Ducted Heating/Cooling (HVAC) System? ☐ No ☒ Yes HVAC Air Intake in Basement? ☐ No ☐ Yes  
Open windows in sampling area(s)? ☐ No ☐ Yes Odors in basement/building? ☒ No ☐ Yes (describe below)  
Comments: 1st fl - smoke open door  
boiler forced hot water serviced December

USE/STORAGE OF OIL OR HAZARDOUS MATERIALS

Oil Tank in Basement/Building? ☐ No ☒ Yes: Oil odor near tank? ☐ None ☐ Weak ☐ Strong (\_\_\_\_ ppmv)  
Gasoline Storage in Basement/Building (e.g., lawn mowers, 5 gallon containers)? ☐ No ☐ Yes  
Other OHMs observed: ☐ Paints/Stains ☐ Cleaning Solvents ☐ New Building Materials ☐ Other: \_\_\_\_\_  
Comments/Description: 2 holes - potential sumps staining on floor 2 systems - 1 oil, 1 gas

PID SCREENING OF CRACKS/ANNULUS SPACES

PID screening of annulus space around utilities pipes through basement wall/floor? ☐ Yes ☐ No ☐ Not Accessible  
PID screening of cracks in wall/floor and/or wall/floor interfaces? ☒ Yes ☐ No ☐ Not Accessible ☐ No Cracks  
PID screening of space above drain sump? ☐ Not Applicable ☐ Not Accessible ☒ Yes ☐ No  
Results of Screening/Comments:  $\emptyset$

SAMPLE/COLLECTION INFORMATION

Sample ID:	Location	Time	Date	PID PPMV
25-B	Basement	9:50	2/9/05	0
25-1	1st floor	9:45	2/9/05	0

SAMPLING PROCEDURE: ☐ (1) Run PID pump for at least 60 seconds to purge. (2) With tube on outlet, direct discharge into an inverted 40 mL vial. (3) Sample for 30-60 seconds. (4) Slowly withdraw tube from vial while PID pump running. (4) Tightly cap vial, label, and store in dark (DO NOT COOL/REFRIGERATE). ☐ Other procedure used (describe on back of form)

Samples Collected By: Irene Dale

Comments on Back: ☐ No ☐ Yes



MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION  
Northeast Regional Office/Bureau of Waste Site Cleanup  
INDOOR AIR SCREENING/SAMPLING FORM

RELEASE TRACKING NUMBER

3-

24376

TOWN

Somerville

Address: 27 Tufts St.

Name/Identifier:

Richard Papa

**BUILDING INFORMATION (check all that apply)**

Type of Building: ☒ Residential ☐ Commercial ☐ Industrial ☐ Mixed ☐ Other: \_\_\_\_\_  
Foundation Type: ☐ Finished Basement ☒ Full Basement ☐ Partial Basement/Crawl Space ☐ Slab-on-Grade  
Foundation Material(s): ☒ Fieldstone ☐ Concrete Block ☐ Poured Concrete ☐ Other: \_\_\_\_\_  
Foundation Integrity: ☐ No Cracks/Open Joints ☒ Moderate Cracks/Open Joints ☐ Many Cracks/Open Joints  
Basement/Slab Floor: ☐ Concrete/Good Integrity ☒ Concrete with Cracks ☐ Earthen Floor ☐ Carpet/Flooring  
Basement Use: ☒ Storage/Infrequent Use ☐ Recreation/Living Space ☐ Bedrooms ☐ Other: \_\_\_\_\_  
Drainage Sump Present: ☐ No ☒ Yes Standing Water in Sump? ☐ No ☐ Yes Product in Sump? ☐ No ☐ Yes  
Ducted Heating/Cooling (HVAC) System? ☐ No ☐ Yes HVAC Air Intake in Basement? ☐ No ☐ Yes  
Open windows in sampling area(s)? ☒ No ☐ Yes Odors in basement/building? ☐ No ☒ Yes (describe below)  
Comments: PID - 1.1 - L2 Avg. 1.2 <sup>basement</sup> hall outside <sup>starter fluid</sup> paints/solvents <sup>oil/gasoline</sup>

**STORAGE OF OIL OR HAZARDOUS MATERIALS**

Oil Tank in Basement/Building? ☐ No ☒ Yes: Oil odor near tank? ☐ None ☐ Weak ☐ Strong (\_\_\_\_ ppmv)  
Gasoline Storage in Basement/Building (e.g., lawn mowers, 5 gallon containers)? ☐ No ☒ Yes <sup>starter fluid</sup>  
Other OHMs observed: ☒ Paints/Stains ☐ Cleaning Solvents ☐ New Building Materials ☐ Other: \_\_\_\_\_  
Comments/Description: <sup>small</sup> oil spill in basement B-oil/0.2

**PID SCREENING OF CRACKS/ANNULUS SPACES**

PID screening of annulus space around utilities pipes through basement wall/floor? ☒ Yes ☐ No ☐ Not Accessible  
PID screening of cracks in wall/floor and/or wall/floor interfaces? ☒ Yes ☐ No ☐ Not Accessible ☐ No Cracks  
PID screening of space above drain sump? ☒ Not Applicable ☐ Not Accessible ☐ Yes ☐ No  
Results of Screening/Comments:

**SAMPLE COLLECTION INFORMATION**

Sample ID:	Location	Time	Date	PID PPMV
27-B	basement	10:50	2/9/05	0.1-0.2
27-1	1st floor	10:40	2/8/05	1.2

SAMPLING PROCEDURE: ☐ (1) Run PID pump for at least 60 seconds to purge. (2) With tube on outlet, direct discharge into an inverted 40 mL vial. (3) Sample for 30-60 seconds. (4) Slowly withdraw tube from vial while PID pump running. (4) Tightly cap vial, label, and store in dark (DO NOT COOL/REFRIGERATE). ☐ Other procedure used (describe on back of form)

Samples Collected By: Irene Dake

Comments on Back: ☒ No ☐ Yes







## Appendix C

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### GEI's SOP SA-009

**“Air Sampling Using SUMMA Canisters,” revised 2/20/2006.**



Revision Date: February 20, 2006

## STANDARD OPERATING PROCEDURE FOR AIR SAMPLING USING SUMMA CANISTERS

### Objective

The purpose of this SOP is to describe the general procedures for collecting ambient air, indoor air, or soil gas samples using SUMMA canisters.

### General

Before sampling, establish the data collection objectives and consult guidance materials from the state where the sampling will be performed. Different states have different guidelines. Below are potentially relevant policies.

<b>Massachusetts</b>	<ul style="list-style-type: none"><li>Indoor Air Sampling and Evaluation Guide (MADEP, WSC Policy #02-430).</li><li>Characterizing Risks Posed by Petroleum Contaminated Sites (MADEP WSC-02-411).</li><li>Massachusetts Threshold Effects Exposure Limits (TELs) for Ambient Air (December 5, 1995 Memorandum).</li></ul>
<b>Minnesota</b>	<ul style="list-style-type: none"><li>Indoor Air Sampling at VOC Contaminated Sites: Introduction, Methods, and Interpretation of Results (January 8, 2004).</li></ul>
<b>New Hampshire</b>	<ul style="list-style-type: none"><li>Draft Vapor Intrusion Guidance (NHDES, April 8, 2005).</li></ul>
<b>New Jersey</b>	<ul style="list-style-type: none"><li>Draft Vapor Intrusion Guidance (NJ DEP, June 2005).</li></ul>
<b>New York</b>	<ul style="list-style-type: none"><li>Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH, Public Comment Draft, February 2005).</li></ul>
<b>Wisconsin</b>	<ul style="list-style-type: none"><li>Chemical Vapor Intrusion and Residential Indoor Air. Wisconsin Department of Health and Family Services (DHFS, February 13, 2003). <a href="http://www.dhfs.state.wi.us/eh/Air/fs/VI_prof.htm">http://www.dhfs.state.wi.us/eh/Air/fs/VI_prof.htm</a></li></ul>
<b>USEPA</b>	<ul style="list-style-type: none"><li>Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. Document EPA530-F-02-052 (2002). <a href="http://www.epa.gov/correctiveaction/eis/vapor.htm">http://www.epa.gov/correctiveaction/eis/vapor.htm</a></li></ul>

### Preliminary Steps for Indoor Air Sampling

1. Conduct an inventory of the building to be sampled. Consult the state guidelines for the inventory forms to be completed. An example pre-sampling field checklist is attached.
2. To the extent practicable, remove materials suspected of emitting volatile organic compounds (VOCs) or naphthalene from the test area. These materials

should be removed from the test area as far in advance of sampling as practicable, preferably at least 24-hours in advance of sampling.

3. If there are materials suspected of emitting VOCs or naphthalene and these materials can not be removed from the test area, screen the materials with a photo-ionization detector (PID), flame ionization detector (FID), or other screening instrument to evaluate the degree to which VOCs or naphthalene are being emitted by the material. Before proceeding with sampling, contact the project manager for additional guidance.
4. Follow state guidelines for building preparation prior to and during sampling.

### **Sampling Procedure**

1. Record data on the canister tag, in the field notebook, and on the sampling log sheet as applicable. An example log sheet is attached. Do not use a writing instrument that emits VOCs (e.g. a “SHARPIE” pen).
2. Prepare a diagram in the field notebook identifying each sampling location. Position canisters following these general criteria:
  - Air samples should be collected in the breathing zone for either an adult or child, as appropriate.
  - For indoor air samples, the sample should be collected from the middle of the room or close to a suspected source of intrusion of the contaminants of concern.
  - For outdoor (ambient) air samples, the flow regulator should be a “candy-cane” shape to prevent water from entering the SUMMA canister. The canister should be placed in a secure position and may be chained to a fence or other securing feature.
3. Label the tag attached to the canister with the sample ID number. In inclement weather, protect the tag by covering it with a zip lock bag.
4. For each canister and regulator, record in the field book and on the log sheet the: canister serial number (usually on the tag and marked on the canister), flow regulator serial number, sample ID, sampling location, sample date, and start and end time.
5. Remove the dust cap (usually a brass fitting) from the valve of the canister.
6. Confirm and record the initial canister vacuum.
  - Use either the vacuum gage on the flow regulator or a separate, laboratory supplied gage to measure the canister vacuum. If using a separate vacuum gage that is not part of the flow regulator, make sure the valve on the canister is closed before removing the gage.
  - Attach the flow regulator to the canister inlet, turning the threaded nut until it is hand tight. Use a wrench to tighten the flow regulator. The fittings on the flow regulator should be tight. To check this, pick up the canister and turn it clockwise or counter clockwise from the regulator. The regulator and the canister should turn as one unit. If the regulator

spins and the canister does not spin with it, then the valve has to be tightened.

- Compare this reading to the vacuum reported by the laboratory supplying the canister. The readings should be in general agreement and approximately -30 inches mercury (refer to laboratory chain-of-custody for the initial vacuum reading). Record the initial vacuum on the canister tag, in the field book, and on the log sheet. Remove the vacuum gauge.
7. To start sampling, open the canister valve fully, turning the valve counter clockwise 1½ to 2 turns. Record the start time and the vacuum on the canister tag, in the field book and on the log sheet. The vacuum should decrease slowly as the sample is collected.
  8. Photograph each sampling location and the surrounding area. Photograph each canister at the beginning of the test and at the end of the test before disturbing the canister. The purpose of photographing the canister at the beginning and end of the test is to obtain data that can be used to evaluate whether the canister was disturbed during the testing period.
  9. To end sampling, close the canister valve fully, turning the valve clockwise until it is hand tight. Record the end time and the final vacuum on the canister tag, in the field notebook, and on the log sheet. If the valve is not closed after sampling, the canister could sample more air after sampling has finished and the results may be compromised. For 6-liter canisters, the required final vacuum is between -5.0 inches of mercury and -0.5 inches of mercury. Contact the laboratory to determine the appropriate final sampling vacuum based on the size of the canister used and the duration of sampling.
  10. Disconnect the regulator from the canister, replace the dust cap and return both to the laboratory in the boxes they were shipped in. Prepare a specific air sampling chain-of-custody form to accompany the shipment.

## **Equipment**

The following equipment is typically used during sampling:

- SUMMA canister that is provided by the testing laboratory and sized to accommodate the sampling required.
- Flow regulator that is provided and adjusted by the laboratory to accommodate the sampling duration.
- Flow splitter provided by the laboratory for duplicate sampling (if applicable).
- Signs to be placed on the canisters that indicate air sampling in process with contact information.
- Camera, measuring tape, locks and chains, field notebook.

## QA/QC

1. If appropriate, an extra canister should be available for each sampling round in case of malfunction of one of the other canisters.
2. Collect a duplicate for every 20 samples. The duplicate should be collected in an area where contamination is known or suspected to be present. Field duplicates of air samples are collected using a splitter on the air intake. Remove the stainless tubing inlet from the flow regulator. Attach the flow regulator to each canister, then attach a branch of the splitter to each controller. Be sure to open the valve on both canisters at the same time.
3. A trip blank should be “collected” for every 20 samples. The trip blank is another canister that is not used for sampling and should have a custody seal on its inlet. The trip blank canister is removed from the shipping container, and transported to each location where sampling is occurring and then sent back to the laboratory unopened and with the custody seal intact.

### Attachments:

- Pre-sampling Field Checklist
- Sampling Checklist

N:\04516\QAPP - Air Monitoring\AIR SAMPLING SOP 01-31-06 mam.doc



# PRE-SAMPLING FIELD CHECKLIST FOR INDOOR AIR SAMPLING

Survey Completed by: \_\_\_\_\_ Date: \_\_\_\_\_

Site Name: \_\_\_\_\_ Case #: \_\_\_\_\_

## Part I - Occupants

Building Address: \_\_\_\_\_

Property Contact: \_\_\_\_\_ Owner / Renter / other: \_\_\_\_\_

Contact's Phone: home ( ) \_\_\_\_\_ work ( ) \_\_\_\_\_ cell ( ) \_\_\_\_\_

Building occupants: Children under age 13 \_\_\_\_\_ Children age 13-18 \_\_\_\_\_ Adults \_\_\_\_\_

## Part II – Building Characteristics

Building type: single-family residential / multi-family residential / office / strip mall / commercial / industrial

Describe building: \_\_\_\_\_

Number of floors - below grade: \_\_\_\_\_ (full basement / crawl space / slab) at or above grade: \_\_\_\_\_

Basement size: \_\_\_\_\_ ft<sup>2</sup> Basement floor: concrete / dirt / floating / other (specify): \_\_\_\_\_

Foundation type: finished basement / full basement / partial basement / crawl space / slab on grade

Foundation materials: poured concrete / cinder blocks / stone / other (specify) \_\_\_\_\_

Foundation integrity: no crack or open joints / moderate cracks or open joints / many cracks or open joints

Basement / slab floor: concrete; good integrity / concrete with cracks / earthen floor / carpet or flooring

Basement use: storage; infrequent use / recreation or living space / bedrooms / other (specify) \_\_\_\_\_

Type of ground cover around outside of building: grass / concrete / asphalt / other (specify) \_\_\_\_\_

Moisture conditions in basement: wet / damp / dry / other (specify) \_\_\_\_\_

Basement sump present? *Yes/No* Sump pump? *Yes/No* Standing water in sump? *Yes/No* Product in sump? *Yes/No*

Type of heating system (circle all that apply):

hot air circulation	hot air radiation	wood	steam radiation	hot water radiation
kerosene heater	electric baseboard	heat pump	other (specify): _____	

Type of ventilation system (circle all that apply):

central air conditioning	mechanical fans	bathroom ventilation fans
individual air conditioning units	kitchen range hood fan	other (specify): _____

Type of fuel utilized (circle all that apply):

Natural gas / electric / fuel oil / wood / coal / solar / kerosene / outside (fresh) air intake

Septic system? *Yes / Yes (but not used) / No* Irrigation/private well? *Yes / Yes (but not used) / No*

Building address: \_\_\_\_\_

Existing subsurface depressurization (radon) system in place?      *Yes / No*                      and running? *Yes / No*

Has the building been weatherized with any of the following:  
                                 insulation    /   storm windows / energy efficient windows    Other (specify): \_\_\_\_\_

Comments:

**Part III - Outside Contaminant Sources**

MADEP Comprehensive Site List (1000-ft. radius): \_\_\_\_\_

Other stationary sources nearby (gas stations, emission stacks, etc.): \_\_\_\_\_

Heavy vehicular traffic nearby (or other mobile sources): \_\_\_\_\_

**Part IV – Indoor Contaminant Sources – *Use additional sheets if necessary***

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor & room), and whether the item was removed from the building 48 hours prior to indoor air sampling event.

Potential Sources	Location(s)	Removed Prior to Sampling? (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents		
Oven cleaners		
Carpet / upholstery cleaners		
Other house cleaning products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners		
Fuel tank (inside building)	If Yes is, is there an odor near tank? <i>None / weak / strong</i>	NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring		NA
Recent painting in building?		NA
Hobbies - glues, paints, etc.		

**Part V – PID Screening - *Use additional sheets if necessary***

PID screening of annular space around utility pipes through basement wall / floor? *Yes / no / not accessible*

PID screening of cracks in wall/ floor and/or wall/floor interface: *Yes / no / not accessible / no cracks*

PID screening above space above drain sump? *Not applicable / Yes / no / not accessible*

Results of screening / comments :

**Part V – Miscellaneous Items - *Use additional sheets if necessary***

Do any occupants of the building smoke? *Yes / No* How often? \_\_\_\_\_

Has anyone smoked within the building within the last 48 hours? *Yes / No*

Does the building have an attached garage? *Yes / No*

If so, is a car usually parked in the garage? *Yes / No*

Do the occupants of the building have their clothes dry-cleaned? *Yes / No*

When were dry-cleaned clothes last brought into the building? \_\_\_\_\_

Have the occupants ever noticed any unusual odors in the building? *Yes / No*

Describe (with location): \_\_\_\_\_

Any known spills of a chemical immediately outside or inside the building? *Yes / No*

Describe (with location): \_\_\_\_\_

Have any pesticides/herbicides been applied around the building foundation or in the yard/gardens? *Yes / No*

If so, when and which chemicals? \_\_\_\_\_

**Part IV – Indoor Contaminant Sources - (continued)**

Potential Sources	Location(s)	Removed Prior to Sampling? (Yes / No / NA)	Comments

**Part V – PID Screening - (continued)**

PID screening of annular space around utility pipes through basement wall / floor? *Yes / no / not accessible*

PID screening of cracks in wall/ floor and/or wall/floor interface: *Yes / no / not accessible / no cracks*

PID screening above space above drain sump? *Not applicable / Yes / no / not accessible*

Results of screening / comments :

**Part V – Miscellaneous Items - (continued)**

Do any occupants of the building smoke? *Yes / No* How often? \_\_\_\_\_

Has anyone smoked within the building within the last 48 hours? *Yes / No*

Does the building have an attached garage? *Yes / No*

If so, is a car usually parked in the garage? *Yes / No*

Do the occupants of the building have their clothes dry-cleaned? *Yes / No*

When were dry-cleaned clothes last brought into the building? \_\_\_\_\_

Have the occupants ever noticed any unusual odors in the building? *Yes / No*

Describe (with location): \_\_\_\_\_

Any known spills of a chemical immediately outside or inside the building? *Yes / No*

Describe (with location): \_\_\_\_\_

Have any pesticides/herbicides been applied around the building foundation or in the yard/gardens? *Yes / No*

If so, when and which chemicals? \_\_\_\_\_

# Instructions for Residents

(To be followed starting at least 48 hours prior to and during the sampling event)

- Do not open windows, fireplace openings or vents.
- Do not keep doors open.
- Do not operate ventilation fans or air conditioning.
- Do not use air fresheners or odor eliminators.
- Do not smoke in the house.
- Do not use wood stoves, fireplace or auxiliary heating equipment (eg - kerosene heater).
- Do not use paints or varnishes.
- Do not use cleaning products (eg - bathroom cleaners, furniture polish, appliance cleaners, all-purpose cleaners, floor cleaners).
- Do not use cosmetics, including hair spray, nail polish, nail polish remover, perfume, etc.
- Do not partake in indoor hobbies that use solvents.
- Do not apply pesticides.
- Do not store containers of gasoline, oil or petroleum-based or other solvents within the house or attached garage.  
(except for fuel oil tanks).
- Do not operate or store automobiles in an attached garage.

# AMBIENT AIR SAMPLING CHECKLIST

Sampling Location: \_\_\_\_\_

Date: \_\_\_\_\_

Sample ID: \_\_\_\_\_

Sampling personel : \_\_\_\_\_

Summa Canister ID: \_\_\_\_\_

Flow Regulator ID: \_\_\_\_\_

Sample Type / Analysis Method: \_\_\_\_\_

Sampling Start Time: \_\_\_\_\_ am / pm

Sampling Finish Time: \_\_\_\_\_ am / pm

Did Summa Canister go to ambient pressure? Yes / No

Vacuum pressure reported by Laboratory: \_\_\_\_\_

Pressure gauge reading (Pre-opening): Flow Controller: \_\_\_\_\_ Separate gauge: \_\_\_\_\_

Pressure gauge reading (After sample collected): Flow Controller \_\_\_\_\_ Separate gauge: \_\_\_\_\_

Environmental conditions (outside):

Before Sampling

After Sampling

Temperature \_\_\_\_\_

Barometric Pressure \_\_\_\_\_

Prevailing wind direction: \_\_\_\_\_

General weather conditions \_\_\_\_\_

Environmental conditions at sample location):

Before Sampling

After Sampling

Temperature \_\_\_\_\_

Barometric Pressure \_\_\_\_\_

PID readings at sample location (ppm) \_\_\_\_\_

Photographs taken before sampling? Yes / No If Yes, what time: \_\_\_\_\_ Taken by: \_\_\_\_\_

Photographs taken after sampling? Yes / No If Yes, what time: \_\_\_\_\_ Taken by: \_\_\_\_\_

Was the building aired out prior to sample collection? Yes / No If yes, how long? \_\_\_\_\_

Windows open? Yes / No Ventilation fans? Yes / No

Was there significant precipitation within 12 hours of (or during) the sampling event? Yes / No

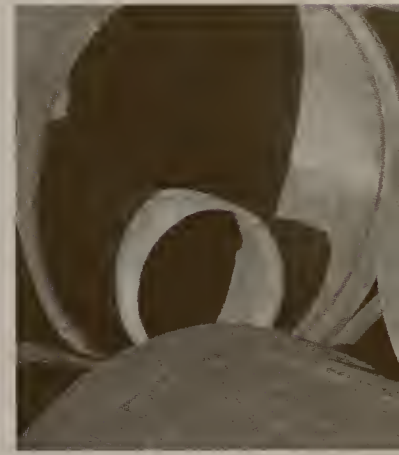
Were any of the residents home during sampling? Yes / No If yes, provide detail: \_\_\_\_\_

Did any of the occupants NOT follow instruction for residents? Yes / No If yes, describe below

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process, as well as a sketch of the sampling location and sample setup indicating height of air intake from ground surface:



Geotechnical  
Environmental and  
Water Resources  
Engineering





## Appendix D

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### Air Sampling Quality Assurance Project Plan (QAPP)





Geotechnical  
Environmental and  
Water Resources  
Engineering

## **Quality Assurance Project Plan (QAPP) – Indoor Air Testing**

Tufts Street, Somerville, Massachusetts

Submitted to:  
Greg Bibler, Esq.  
Goodwin Procter, LLP  
Exchange Place  
53 State Street  
Boston, MA 02109  
RTN: 3-23246, 3-24358, 3-24376

Submitted by:  
GEI Consultants, Inc.  
1021 Main Street  
Winchester, MA 01890  
781-721-4000

April 6, 2006

Project 045160

Ileen S. Gladstone, P.E., LSP  
Vice President



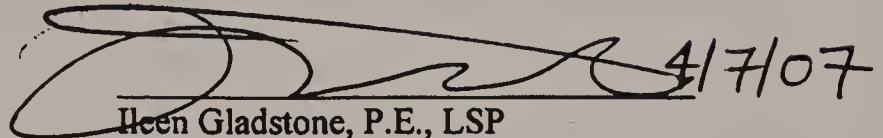
# 1. Title and Approval Page

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Quality Assurance Project Plan (QAPP) – Indoor Air Testing, Tufts Street, Somerville, MA

April 6, 2006

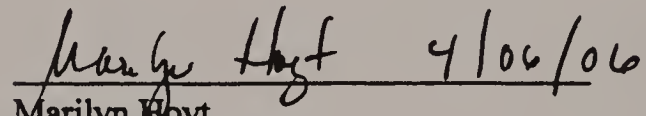
GEI Consultants, Inc. Licensed  
Site Professional:

  
Helen Gladstone, P.E., LSP  
(Signature and Date)

GEI Consultants, Inc. Project Manager:

  
Mark C. Ensign, P.G.  
(Signature and Date)

AMEC Quality Assurance Officer:

  
Marilyn Hoyt  
(Signature and Date)



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(*draft*)



### 3. Distribution List

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Copies of the Quality Assurance Project Plan (QAPP) will be provided to the individuals identified in Table 1.

Complete copies of the QAPP will also be provided to fundamental project personnel. Revisions to the QAPP will be kept on file. Involved project personnel will read the QAPP and agree to follow the procedures described before initiating work.



## **4. Project Organization and Responsibility**

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### **4.1 Project Organization**

Fig. 1 identifies the project organization and responsibilities.

### **4.2 Project Member Responsibilities**

#### **4.2.1 *Project Manager (PM)***

The Project Manager (PM) oversees the development and implementation of the project plans. The PM is responsible for directly managing budgets and project milestones and coordination among personnel, the project laboratory, and other potential subcontractors that may be required during the course of the work. The PM is responsible for confirming that the work is performed in accordance with the QAPP requirements and relaying the needs of the project to the laboratory. The PM will identify specific laboratory needs and requirements and that the laboratory-specific procedures and internally prepared plans and reports meet project QA requirements. The PM will serve as the liaison between the project staff and external laboratories. The PM will be in contact with field personnel on a daily basis to establish the status of the monitoring activities. The PM for this project is Mark C. Ensign, P.G., of GEI.

#### **4.2.2 *Licensed Site Professional (LSP)***

The Licensed Site Professional (LSP) oversees the development and implementation of the project plans. The LSP is responsible for rendering Massachusetts Contingency Plan (MCP) regulatory opinions. The LSP reviews the project work overseen by the PM such as the technical and regulatory approach and documents. The LSP for this project is Ileen Gladstone, P.E., LSP, of GEI.

#### **4.2.3 *Quality Assurance Officer (QAO)***

The Quality Assurance Officer (QAO) will review the QAPP and provide technical review of the proposed sampling procedures. The QAO for this project is Marilyn Hoyt of AMEC.



#### **4.2.4    *Field Personnel***

The field personnel are responsible for maintaining the field notebook, preparing field observation reports, observing the activities of GEI subcontractors, adhering to the QAPP, and collecting samples. Field personnel report to the PM.

#### **4.2.5    *Data Validator***

The project data validator is responsible for checking that the QA/QC requirements of the laboratory have been achieved. Deficiencies in laboratory QA/QC protocols and results will be flagged by the data validator, and shown on the results tables. The project data validator is Nancy Potak, an independent consultant.

#### **4.2.6    *Project Secretary***

The project secretary is responsible for project file management. The project secretary is responsible for tracking project communications and the flow of information into and out of the project files. The project secretary is Carol-Ann Cleri of GEI.

#### **4.2.7    *Laboratory Project Manager (LPM)***

The LPM for this project serves as the primary laboratory contacts for laboratory QA matters for the project and will respond to laboratory related QA needs, and resolve QA problems. The LPM will also assure that appropriate corrective actions are taken on laboratory QA tasks where and however needed. The LPM for this project is Reza Tand, Laboratory Director, of Accutest.



## **5. Project Background**

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### **5.1 50 Tufts Street**

50 Tufts Street, currently owned by Somerville Two, LLC, is located in a residential and commercial neighborhood in East Somerville, Massachusetts (Fig. 2). In 2002, Mr. Francis Margaglione, a prospective purchaser of the property at 50 Tufts Street engaged Sanborn, Head & Associates (SHA) of Westford, Massachusetts, to conduct an environmental due diligence investigation. SHA performed a subsurface exploration program collecting soil and groundwater samples for laboratory analyses. SHA measured perchloroethylene (PCE), trichloroethylene (TCE) and other chlorinated VOCs in soil and groundwater samples in concentrations greater than the applicable Massachusetts Contingency Plan (MCP) reportable concentrations for soil (RCS1) and groundwater (RCGW2).

On September 23, 2004, on behalf of Father & Son Moving & Storage, the building tenant, SHA collected a sample of indoor air from the office portion of the building at 50 Tufts Street and submitted the sample for laboratory analysis of VOCs. PCE (929 parts-per-billion-volume (ppbv)), TCE (43.5 ppbv) and related chlorinated VOCs were detected at elevated concentrations in the air sample. On behalf of the building tenant, SHA reported the Imminent Hazard to DEP on October 22, 2004. DEP assigned RTN 3-24358 to the release. On November 16, 2004, DEP issued an NOR to the John Danais Company.

### **5.2 Groundwater Testing near Tufts Street Residences**

In August 2004, on behalf of Atlantic National Trust, LLC, GeoInsight Inc. of Westford, Massachusetts, installed four groundwater monitoring wells (GEO-3, GEO-4, GEO-5, and GEO-6) along the east side of Tufts Street, approximately 30 to 40 feet from the 50 Tufts Street property (Fig. 3). PCE, TCE and 1,1,1-trichloroethane were detected in groundwater collected from each of the wells.

### **5.3 DEP Indoor Air Testing**

Due to elevated concentrations of PCE in the groundwater adjacent to residences, on February 9, 2005, DEP conducted indoor air screening for chlorinated VOCs in the basement and first floor of the residences located at 9, 11/13, 19, 25, and 27 Tufts Street. The only analyte detected was 0.26 ppmv of PCE taken from the sewer cleanout access port in the basement floor of 19 Tufts Street.



In February and March 2005, DEP coordinated the sampling of indoor air for laboratory testing at the residences located at 9, 11/13, 17, 19, 23, 25, and 27 Tufts Street. Shaw Environmental & Infrastructure (Shaw) of Andover, Massachusetts, collected the samples. A four-hour time weighted average sample was collected from the basement and the first floor of each residence. Accutest Laboratories, Inc., of Marlborough, Massachusetts (Accutest), analyzed the samples for VOCs by US EPA Method TO-15. PCE was detected in air samples from all of the residences except 27 Tufts Street. PCE concentrations ranged from 0.14 ppbv to 1.3 ppbv, with the highest concentration detected in a sample collected at 17 Tufts Street. All concentrations reported were below DEP published concentrations for background levels of PCE in residences.

## **5.4 UniFirst Corporation**

On November 9, 2005, DEP issued a Notice of Responsibility, Notice of Need to Conduct IRA, and Designation of Interim Deadlines (Notice) to UniFirst Corporation to conduct an Imminent Hazard Evaluation (IHE) at 50 Tufts Street, to establish a monitoring plan for seven Tufts Street residences, and to evaluate potential impacts to other receptors.

On January 9, 2006, UniFirst submitted an IRA Plan to DEP. The IRA, which is based on the Notice, included conducting quarterly indoor air monitoring at 17 and 19 Tufts Street at which remedial work has been conducted and conducting semiannual air monitoring additional residences along Tufts Street.

Currently, this QAPP only addresses the indoor air sampling at the residences located at 9, 11/13, 15, 17, 19, 25, and 27 Tufts Street as well as indoor air sampling at 50 Tufts Street.



## 6. Project Description and Schedule

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The primary objective of the work described by this QAPP is to evaluate air quality within selected residential properties located along Tufts Street by collecting indoor air quality data.

### 6.1 Testing Method

Air samples will be collected into evacuated SUMMA canisters equipped with regulators to allow collection of a sample over a 4-hour period. The air samples will be analyzed for selected volatile organic compounds (VOC)s using the TO-15 method. The selected laboratory testing method (TO-15) is appropriate to quantitatively evaluate the presence of chlorinated VOCs in indoor air, including those analytes previously detected within the indoor air of the residences on Tufts Street and in groundwater along Tufts Street. The analyte list includes the chlorinated VOCs and their common reductive dechlorination daughter products that were previously tested for by the Massachusetts Department of Environmental Protection (DEP). Program analytes are listed below:

- Chloroethane
- Chloroform
- Chloromethane
- Carbon Tetrachloride
- 1,1-Dichloroethane
- 1,1-Dichloroethylene
- 1,2-Dichloroethane
- trans-1,2-Dichloroethylene
- cis-1,2-Dichloroethylene
- Methylene Chloride
- 1,1,1-Trichloroethane
- 1,1,2,2-Tetrachloroethane
- 1,1,2-Trichloroethane
- Tetrachloroethylene
- Trichloroethylene
- Vinyl Chloride



## **6.2 Sampling Tasks and Schedule**

### **6.2.1 Collection and Laboratory Analysis of Air Samples – Round 1 (March 2006)**

GEI will collect two indoor air samples from each of the residences located at 9, 11/13, 17, 19, 23, 25, and 27 Tufts Street in March 2006. For each residence, one sample will be collected from the basement and one sample from the first floor living area. GEI will also collect two indoor air samples from 50 Tufts Street. One sample will be collected from the office area and one sample from the central portion of the warehouse. In addition to the indoor air samples, two outdoor ambient air samples will also be collected to evaluate outdoor air background conditions.

Samples will be submitted for laboratory analysis at Accutest Laboratories, of Marlborough, Massachusetts. The air samples will be tested for VOCs using the TO-15 method, and the analyte list presented above.

### **6.2.2 Collection and Laboratory Analysis of Air Samples – Round 2 (May 2006)**

GEI will collect two indoor air samples from each of the residences located at 17 and 19 Tufts Street in May 2006. For each residence, one sample will be collected from the basement and one sample from the first floor living area. In addition to the indoor air samples, two outdoor ambient air samples will also be collected to evaluate outdoor air background conditions.

Samples will be submitted for laboratory analysis at Accutest Laboratories, of Marlborough, Massachusetts. The air samples will be tested for VOCs using the TO-15 method, and the analyte list presented above.

### **6.2.3 Collection and Laboratory Analysis of Air Samples – Round 3 (August 2006)**

The sampling, testing, and reporting activities for Round 3 in August 2006 will be the same as those planned for March 2006, with the exception that sampling will not be conducted at 50 Tufts Street.



#### **6.2.4 Collection and Laboratory Analysis of Air Samples – Round 4 (November 2006)**

The sampling, testing, and reporting activities for Round 4 in November 2006 will be same as those planned for May 2006.

### **6.3 Data Quality Objectives**

The overall objective of this program is to provide defensible data for the concentrations of volatile organics in the ambient and indoor air at the selected residences on Tufts Street and to support human health risk assessments and/or potential remediation needs. In order to meet this objective, procedures for field sampling, custody documentation, laboratory analysis and reporting have been developed and will be implemented to provide data of known and acceptable quality. The following specifics have been considered in developing data quality objectives (DQOs) for this program:

- Data will be collected to monitor the potential impact of an upgradient release of chlorinated organics on indoor air quality at nearby residences.
- Constituents of concern include chlorinated organic solvents and their degradation products.
- Indoor air data may be used to evaluate the extent of vapor intrusion.
- Ambient air data may be used to establish background levels both in the area airshed and in the immediate vicinity of the residences.
- Indoor air data may be used for human health risk assessment purposes.

The parameters that will be used to assess measurement data quality include precision, accuracy, representativeness, completeness, comparability and sensitivity. The Data Quality Objectives (DQOs) specify the limits to potential errors and uncertainty in data that will be used to support decisions.

Precision will be evaluated through laboratory replicate analyses of samples and analyses of field duplicates. The Method TO-15 expectation for precision of replicate analyses of samples is 25 percent relative difference, and this will be the DQO for all analytes present at concentrations 5 times the reporting limit or greater in replicate sample analyses and field duplicate samples.

Accuracy objectives are based on TO-15 control limits for initial and continuing calibration analyses, laboratory control sample analyses and for internal standard recoveries. Accuracy is also dependent on results for blanks; analytes detected in blanks may indicate bias in



sample results from sampling or analytical equipment. Sample analyses should not be conducted unless the method blank is free of target analytes at the reporting limit.

To ensure representativeness, GEI is proposing a rigorous air sampling program (Sections 6.1 and 6.2) that will include the collection of multiple air samples from multiple locations over several quarters. The residential indoor air sampling locations will be selected based on previous air sampling conducted by DEP, and based on a reconnaissance of the interior of the buildings to select locations that are indicative of potential exposure in the basement and first floor living areas within each residence. The exterior air sampling locations will be selected based on prevailing wind directions, access constraints, and other factors (e.g., vicinity site uses) observed during exterior reconnaissance. The sampling locations are listed in the project's air sampling work plan. The residential sampling locations are intended to represent ambient VOC concentration conditions within each residence.

Data will reflect representative seasonal conditions as well as differences within a residence between the basements and first floor living areas. These locations and the sampling and analytical protocols are comparable to those for the MADEP program and are standard for indoor and ambient air characterization.

Completeness is a measure of the percentage of samples and data points generated that are valid and defensible. Completeness depends not only on the analytical data quality, but also on the completeness of the documentation for all aspects of the sampling and analyses. While the completeness goal for this project is 100 percent, samples or individual data points may be compromised by unanticipated conditions. In the event that this occurs, the overall impact on the program objectives will be evaluated to determine if re-sampling is warranted.

The sensitivity of the analyses must be sufficient to provide data suitable for risk assessment purposes. Accutest reporting levels of 0.2 ppbv for the selected analytes are consistent with existing DEP data for these residences and with anticipated human health risk assessment program requirements.



## **7. Sampling Design, Procedures and Requirements**

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### **7.1 Sampling Design**

Proposed sampling locations have been identified with the objective of collecting data to assess the indoor ambient air quality for selected residential properties along Tufts Street. The locations of the residences where indoor air will be sampled are shown on Fig. 3.

### **7.2 Pre-monitoring Inventory**

Between 24 to 48 hours before starting work GEI will conduct a pre-monitoring inventory and survey of each residence, as well as at 50 Tufts Street, to identify VOC-containing materials and to the extent possible remove them from the residence or warehouse. The results of the pre-monitoring inventory and survey will be recorded on individual forms. After the pre-monitoring inventory and survey is complete, GEI will provide the residents with written instructions identifying activities they should not do until the sampling round is completed. Residences and 50 Tufts Street will also be screened using a photoionization detector (PID) to identify possible sources of VOCs in the indoor air. The PID will be calibrated in accordance with the manufacturer's instructions as described in Section 9.

### **7.3 Air Sample Collection**

Air samples will be collected into 6-liter evacuated SUMMA canisters with calibrated regulators and analyzed for VOCs by method TO-15. Each SUMMA canister will be individually tested and certified as clean by the laboratory prior to its use for this program. Regulators used for air sampling will be cleaned by the laboratory prior to use.

Each indoor air sample will be collected over a 4-hour period. The samples will be collected in accordance with the GEI SOP in Appendix A. Sampling procedures for VOCs will be in general conformance with the guidelines in the U.S. EPA's Compendium Method TO-15, "The Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA Passivated Canister Sampling and Gas Chromatographic Analysis" and also in general conformance with the DEP's "Indoor Air Sampling and Evaluation Guide, WSC Policy #02-430," dated April 2002.

Sampling will be conducted between Monday through Friday, for a 4-hour period within 9am to 5pm, to minimize potential impacts that resident behavior may have on indoor ambient air, as well as to minimize disturbances to residents. Within each residence, the basement and



first floor samples will be collected concurrently. The sampling field form that is included in the GEI SOP for Indoor Air Monitoring, will be completed at the time of sampling and will record information such as:

- Initial and final vacuum pressures.
- Weather conditions (temperature, barometric pressure, wind direction).
- Indoor temperature.
- Whether residents are home at the time of sampling.
- Sample and canister ID.

Refer to Section 11.1.2 and Appendix A for further information regarding information collected during air sampling.

Decontamination of the air sampling and monitoring equipment will be conducted by the laboratory. No field decontamination activities will be required.



## **8. Sample Handling and Custody Requirements**

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Air samples will be handled in accordance with GEI SOP RE-007 “Chain of Custody” (Appendix A). The SUMMA canisters should be maintained at ambient temperature and require no other special preservation techniques or handling for shipment, except that the regulators should be removed before transport. The maximum holding time for an air sample in a SUMMA canister for TO-15 testing is 28 days.

At the time of collection, samples will be assigned unique, project specific sample identifications. The sample identification will begin with the project number followed by the applicable residential street address, and whether the sample was collected in the basement or on the first floor. For example, “045160-17Tufts-1” would identify an air sample collected from the first floor of 17 Tufts Street. Sample identification numbers will be recorded on labels attached to each canister.

Samples will be transported under a chain of custody by GEI and/or Accutest couriers.



## 9. Field Analytical Method Requirements

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The field analytical method will be the screening of ambient air conditions using a PID. GEI's SOP TE-001 for VOC field screening is in Appendix A. The PID will be calibrated in accordance with the manufacturer's instructions as described in the operation manual in Appendix B using isobutylene. The PID will be calibrated in the GEI's Winchester, Massachusetts, laboratory to avoid the potential for calibration gases to be detected during air sampling.

Field screening will be done as part of the pre-monitoring inventory and survey for each residence to identify VOC-containing materials and to the extent possible remove them from the residence, as discussed in Section 7.1. Results of field screening will be recorded on the pre-monitoring inventory and survey form.

Immediately prior to and during air sampling at each location, field screening will be done in the area of the sampling location. Results of field screening will be recorded on the sampling field form.



## 10. Fixed Laboratory Analytical Methods and Requirements

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The air samples will be submitted to Accutest for analysis by the TO-15 method. The Laboratory SOP for the TO-15 method is in Appendix C. Table 3 identifies the preventive maintenance performed by the laboratory on their equipment. Table 4 identifies the calibration requirements and associated corrective actions for laboratory equipment.



## 11. Quality Control Requirements

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Quality Control (QC) checks are performed to confirm that data collected is both representative and valid. QC checks are performed in the field and the laboratory.

### 11.1 Field Quality Control

QC checks of the field activities include the following:

- Using SOPs for field activities.
- Pre-sampling inventory of VOC-containing materials in the residences.
- Using standardized checklists and field notebooks for recordkeeping.
- Verifying the vacuum in sampling containers before and after sampling.
- Calibrating the field equipment.
- Collecting field QC samples.

Calibration of the PID is summarized in the applicable SOP in Appendix A, and in detail in the PID operations manual in Appendix B.

#### 11.1.1 *Standard Operating Procedures*

The SOP in Appendix A detail the procedures for each of the field activities performed during the investigation. The SOPs are formatted in a generalized step-by-step manner and include a section on precautions.

#### 11.1.2 *Recordkeeping*

The use of field notebooks and standardized checklists helps to provide adequate documentation of field activities changes in procedures, and site conditions. The type of information recorded in field notebooks and in the field sampling checklist includes:

- Procedures used and deviations.
- Sample location, type, identification number.
- Weather conditions, including temperature, barometric pressure, and wind direction.
- Date and field personnel on site.



- General observations regarding ventilation of sampling location.
- Problems and corrective actions taken.
- Time and events.
- Equipment identification numbers.
- Initial and final vacuum pressures.
- Field screening information.

### **11.1.3 Field QC Samples**

Field QC samples are important QC checks. The purpose of field QC samples is to monitor the precision and accuracy of the combined sampling and analytical program. Field duplicates, one trip blank and two ambient air samples will be collected for each sampling round. Field QC samples are handled, transported, and analyzed in the same manner as the actual field samples.

#### Field Duplicates

Field duplicates are two samples taken from the same location, but submitted in separate containers and analyzed separately. Information from the analysis of field duplicate samples is used to evaluate the precision of sampling procedures. Field duplicates of air samples will be obtained by using a splitter on the air intake. The duplicate samples will be submitted to the laboratory “blind” (i.e. the laboratory will not be informed that the sample is a duplicate sample). Two field duplicates will be collected during round 1 and 3 (March and August) of air monitoring. One field duplicate will be collected during round 2 and 4 (May and November).

#### Trip Blanks

One trip blank will be submitted for laboratory analysis during each round of air monitoring to demonstrate that no volatile compound exposure occurs during the transport of samples both to and from the sampling site, or during shipment to the laboratory.

Trip blanks for air samples consist of laboratory-prepared, evacuated SUMMA canisters that will be transported with the SUMMA canisters that will be used to sample indoor air at the site. The trip blank will remain on-site during sampling, and then will be returned to the laboratory with the SUMMA canisters containing the indoor air samples. The trip blank SUMMA canister will be partially filled with inert clean gas and then analyzed for VOCs using the TO-15 method.



### Ambient Air Samples

GEI will collect two ambient air samples during each round of air monitoring to evaluate the potential presence of chlorinated VOCs in the ambient outdoor air. One ambient air sample will be collected upwind of the currently identified disposal site, but not within the areal extent of known VOC-contaminated groundwater. This sample will be used to evaluate the background air without any site contributions. A second outdoor air sample will be located proximate to an existing groundwater observation well where elevated levels of VOCs have been detected, such as (GEO-4). This sample will be used to evaluate the potential impact on ambient air from migration of VOCs from groundwater through soil and possible contributions to indoor air levels.

## **11.2 Laboratory Quality Control Checks**

Analytical activities used by Accutest as QC checks include:

- Method blanks.
- Calibration check and verification samples.
- Replicate analysis.
- Internal standards and surrogates.

### **11.2.1 Canister Preparation**

Canisters are cleaned between each field use by the laboratory. Each canister used in this program will be individually certified as clean prior to its use. After cleaning, the canister is filled with clean air and then analyzed. Canisters are acceptable for use only if no target analytes are detected at the reporting limit of 0.2 ppbv.

### **11.2.2 Methods for Laboratory Quality Control**

Table 6 is a summary of the laboratory quality control requirements, associated acceptance criteria, and the applicable corrective actions. Accutest's Quality Assurance Plan (on file at GEI) explains the type and frequency of quality control checks. These checks include analysis of certified reference standards, laboratory duplicates, blanks, and the use of internal standards.

Table 7 and Appendix D present the reporting limits for the compounds the laboratory will be testing for, the action limits, and the level of precision (%RPD) and accuracy (%R) required for the project. The Massachusetts Department of Environmental Protection's published indoor air background concentrations for the 16 chlorinated VOCs that will be analyzed are also presented on Table 7.



Sections 14 (Sample Analysis) and 16 (Quality Control) in Accutest's SOP (Appendix C) provides a detailed explanation of the quality control measures used by the laboratory including; performance tuning, initial calibration, continuing calibration, internal standard, method blank, laboratory control sample/laboratory control sample duplicate, and surrogate. Tables 1, 2, and 3 in Accutest's SOP (page 24) present the instrument tune requirements, internal standard masses and recovery limits for the surrogate. GEI's Table 8 presents the percent recovery acceptance limits for the surrogate 4-bromofluorobenzene. In summary, the laboratory checks the calibrations before an analysis can begin. If the analytical system does not pass the QC check, then the system is evaluated, and the QC check is reanalyzed to verify the calibration. If the system is still out of calibration the instrument is recalibrated and the process begins anew.



## **12. Documentation, Records, and Data Management**

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### **12.1 Field Documentation**

Field observations will be documented in accordance with GEI SOPs RE-001, RE-007, and other applicable field sampling SOPs identified in Table 2 and in Appendix A. Entries into field books will be made in ink with corrections made by putting a single line through the error and initialing and dating the change.

Sample labels and chain of custodies will be prepared in accordance with GEI SOP RE-007 (Appendix A).

### **12.2 Laboratory Documentation**

Accutest will record the analyses of samples in a bound laboratory notebook, specific for each instrument. For each analytical run, any deviations from the analytical method SOP will be recorded. Corrective actions taken by the laboratory will be recorded in the notebook. Where applicable, laboratory data will be recorded and stored by the laboratory both in electronic and hard copy. Data reviewed internally by the laboratory and approved by the LPM will be reported in a laboratory data report.

Accutest will notify GEI of any sample or analytical conditions that may adversely affect data quality at the time that this is noted by the laboratory. Such conditions may include loss of vacuum in the canister between the time sample collection ended and when checked prior to analysis or the presence of background levels of VOC in laboratory air as noted in method blanks that may bias results. GEI will determine whether analyses should proceed.

Section 13.4 of this QAPP details the reporting requirements for the project. Deviations from the laboratory SOP and data limitations, if any, will be identified in narrative as part of the laboratory data report. The laboratory report will be provided to GEI in hard copy and as a PDF file. Electronic data deliverables (EDDs) will be provided to GEI, as well as all raw data associated with sample analyses.

### **12.3 GEI File Maintenance**

The project secretary will maintain the project files at GEI. At the conclusion of each round of sampling, GEI will prepare a summary report that includes copies of the laboratory data



reports. Project records will be “maintained in accordance with GEI’s document retention policy, which is on file at GEI’s Winchester office.”



## **13. Assessment Oversight**

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Assessment oversight planned as part of the QAPP includes:

- Field Sampling Technical System Audit (TSA)
- Field Analytical TSA
- Fixed Laboratory TSA
- Data Package TSA
- QA/QC Management Reports

### **13.1 Field Sampling Technical Systems Audit (TSA)**

A Field Sampling TSA will be performed by the PM at the start of field activities to confirm that field sampling is being performed in accordance with the QAPP. Specifically, a Field Sampling TSA will be performed at the start of air sampling. Deviations from the SOPs and QAPP that are observed will be brought to the attention of the field personnel and corrective action taken under the direction of the PM.

### **13.2 Field Analytical TSA**

A Field Analytical TSA will be performed by the PM at the same time as the Field Sampling TSA. Deviations from the SOPs and QAPP that are observed will be brought to the attention of the field personnel and corrective action taken under the direction of the PM.

### **13.3 Fixed Laboratory TSA**

A Fixed Laboratory TSA specific to this project will not be performed. However, as part of GEI's overall laboratory services procurement process, GEI has performed an on-site audit of Accutest. Accutest received a favorable review during the on-site audit performed by GEI.

### **13.4 Data Package TSA**

Accutest will provide laboratory data reports, which will include the following information:

- Signed transmittal letter.
- Narrative documenting any deviations from the laboratory SOP and data limitations.



- Report forms for each sample with field and laboratory identifiers, dates of sampling, receipt and analysis, dilution factor, results and reporting limits for each analyte, and surrogate % recovery. Results and limits should be reported both as ppbv and  $\mu\text{g}/\text{m}^3$ .
- Method blank results.
- Laboratory control sample results and % recoveries.
- Instrument performance check (BFB tune).
- Initial calibration summary with % RSDs.
- Calibration verification summary with %RDs.
- Continuing calibration summary with % RDs.
- Internal standard and retention time summaries.
- Replicate analysis summary, including % RDs.
- Chromatograms and integration tables for all analyses, including samples, standards and blanks.
- Copy of run logs.
- Original COC form.
- Original Canister Field Data Form.
- Canister and regulator certifications, including dates of certification analyses.
- Copies of chromatograms and integration tables from certification analyses.

The laboratory report will be provided to GEI in hard copy and as a PDF file. EDDs will be sent to GEI via email. The laboratory will retain and maintain all raw data including chromatographs and copies of all instrument log books.

Data Package TSAs will be performed by the Data Validator for laboratory data packages. The Data Package TSAs will be performed in accordance with GEI SOP RE-008 (see Appendix A). This validation is independent of the data validation performed internally by the Accutest LPM. Deviations from the requirements of the QAPP will be brought to the attention of the laboratory and PM and corrective actions taken.

## 13.5 QA/QC Management Reports

Conditions identified by the PM during the field sampling TSAs and field analytical TSA will be recorded in the field notebook by the PM along with corrective actions taken. Data review summaries prepared by GEI in accordance with GEI SOP RE-008 will provide a written record of the Data Package TSAs and be provided to the PM immediately following



preparation. A QA/QC section will be included in each summary report following the sampling.



## **14. Data Validation and Usability**

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### **14.1 Data Validation**

GEI has engaged Nancy Potak, an independent data validator, to check the reported data for conditions that would require qualifying the use of the data in some way and potentially limit GEI's ability to use the data for the project purpose. A detailed description of the data validation is included in Section 14, and is summarized below.

Data validation in accordance with GEI SOP RE-008 (Appendix A) and consistent with US EPA Region I, Data Validation Functional Guidelines for Evaluating Environmental Analysis (December 1996) will be performed on 100 percent of the laboratory data collected during the project. Data validation for samples will include a review of holding times, continuing calibration analyses, internal standards, surrogates, reporting limits, chain-of-custody records, and QC samples. Holding times, reporting limits, surrogate recovery, and duplicate precision will be assessed relative to the information in Tables 6, 7, and 8. The procedures for flagging data will follow the guidelines presented in US EPA, Region I, Laboratory Data Validation Functional Guidelines For Data Validation (1996) and US EPA Data Quality Tables for "Volatile Organic Compounds (VOCs) in Ambient Air Using Summa Canister Sampling and Gas Chromatography (GC) Analysis."

Accutest will generate laboratory data. Prior to release by the laboratory, the data must first meet the specific QA/QC associated with the SOP that was used for the analysis and the requirement of this QAPP. Accutest employs a system of sign-off sheets where each analyst must sign-off after their respective part of the analysis is complete and confirm that the analysis meets the QA/QC requirements of the specific SOP. Deviations must be noted and explained in the project narrative that is part of the final laboratory data report. The LPM at the laboratory is responsible for the final verification of the data and preparation of the laboratory data report including the project narrative.

### **14.1 Data Quality Indicators**

This section of the QAPP discusses the methods used to evaluate the data quality indicators. The data quality indicators include precision, accuracy, representativeness, sensitivity, completeness, and comparability. Each of these data quality indicators is discussed below.



### **14.1.1 Precision**

Precision is a measure of mutual agreement among individual measurements of the same property, under prescribed conditions. Precision will be calculated from duplicate measurements and is expressed as the relative percent difference (RPD). The RPD will be calculated using the following equations:

$$RPD = \frac{(C1 - C2)100\%}{((C1 + C2) \div 2)100\%}$$

where:

C1 = The larger of the two observed values

C2 = The smaller of the two observed values

Field duplicate results will be in the laboratory data tables of the final report. The acceptable RPD value for the analysis being performed is 25 percent. Duplicate results that are above these RPD limits will be flagged on the data tables.

### **14.1.2 Accuracy**

Accuracy will be calculated on the basis of the continuing calibration analyses, and internal standards and the surrogate. A gas with a known concentration of the given parameter will be analyzed. The recovery is calculated based on the detected concentration, and the known concentration of the gas.

$$P = 100\% (A/B)$$

where:

P = Percent Recovery

A = The detected concentration of the gas

B = The known concentration of the gas

Composition and concentrations for the gas will be consistent with the analytical SOPs in Appendix B. The acceptable accuracy limits for the laboratory analysis being performed are presented in Table 7 and Appendix D. The calculated accuracy will be compared to the acceptable accuracy limits. Analysis results for samples that do not meet the accuracy limits will be flagged on the data tables.

Accuracy will also be evaluated through the use of trip blanks and method blanks. Data generated from the analysis of trip blanks and method blanks will be used to evaluate if field



or laboratory contamination has occurred. Analytical results for samples associated with contaminated trip blanks or method blanks will be flagged on the data tables.

### **14.1.3 Representativeness**

As noted in Section 6.3, indoor air and ambient air sampling locations will be selected with careful consideration to representativeness. Any conditions or activities noted at a location or during sampling that may impact the representativeness of the data will be noted on field logs. GEI will review the project data for representativeness. Unexpected, unusual, or anomalous results will be identified in the final project report and flagged on the data tables.

### **14.1.4 Sensitivity**

Compounds identified as non-detected that have a laboratory reporting limit above the applicable DEP published indoor air background numbers, if one exists, will be flagged on the data tables.

### **14.1.5 Completeness**

The project completeness goal is 100 percent of the samples being successfully analyzed in accordance with the requirements of the QAPP. If less than 90 percent of the samples are analyzed successfully, more sampling may be required to meet the project goals. The air samples collected at 17 and 19 Tufts Street are considered critical samples to evaluate if the remedial actions to seal the basements and walls at these residences reduced the indoor air concentrations of VOCs.

### **14.1.6 Comparability**

Comparability is an assessment of the degree to which different data sets can be appropriately compared to each other. Comparability is controlled by the use of standardized methods in the field and laboratory. Comparability is a qualitative measure that will be made by the PM based on consistent adherence to the project SOPs and the requirements of the QAPP.

GEI has requested the complete data lab packages for sampling previously conducted by the DEP. To date GEI has not received this data, and consequently a detailed, direct comparison is not possible. GEI continues to work to obtain this information, and will use the data for comparisons when it is obtained.



## 14.2 Data Usability

Data usability will be evaluated relative to the EPA approved sampling and testing methods used, and GEI's evaluation of the Data Quality Indicators in relation to the project purpose. GEI will assess the deviations in Data Quality Indicators relative to the DEP published background levels of VOCs in indoor air to evaluate the potential for the under- or over-estimation of VOC concentrations in indoor air. Data and in particular duplicate samples will also be evaluated based on the range of detected concentrations relative to concentrations that may pose potential risk. Data that is identified as over- or under-estimating the VOC concentrations in indoor air will be qualified. Data that are identified as not meeting the project purpose will be qualified and will be excluded from use in the proposed risk characterization.

The data generated will be considered as a whole relative to the project goals. Specifically, GEI will assess whether the data set can be used to:

- Evaluate whether indoor air at the selected residences are being impacted by chlorinated VOCs associated with the Site. Key to this evaluation will be a determination as to whether the data set includes false positives or false negatives.
- Evaluate whether the Site poses no significant risk to the residents along Tufts Street.

If the project data set as a whole cannot be used to assess the items identified above, additional data (e.g. resampling and/or additional investigation) may be required to meet the project objectives.



## 15. References

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- Massachusetts Department of Environmental Protection, "Indoor Air Sampling and Evaluation Guide, WSC Policy #02-430," dated April 2002.
- U.S. Environmental Protection Agency Region I, Data Validation Functional Guidelines for Evaluating Environmental Analysis, dated December 1996.
- Massachusetts Department of Environmental Protection, "MCP-GW2 Background Indoor Air Concentrations (guidance memorandum)," dated August 2002.
- U.S. Environmental Protection Agency, Compendium Method TO-15, "The Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA Passivated Canister Sampling and Gas Chromatographic Analysis, EPA/625/R-96/010b," dated January 1999.
- U.S. Environmental Protection Agency, "OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), EPA530-D-02-004," dated November 2002.
- U.S. Environmental Protection Agency, "Volatile Organic Compounds (VOCs) in Ambient Air Using Summa Canister Sampling and Gas Chromatography (GC) Analysis", revised 11/16/99.







**Table 1**  
**QAPP Distribution List**  
**Tufts Street**  
**Somerville, Massachusetts**

QAPP Recipients	Title	Organization	Phone Number
Stephen Aquilino	Property Management	UniFirst	978.658.8888 x649
Greg Bibler	Attorney	Goodwin Procter, LLP	617.570.1621
Marylyn Hoyt	QA Officer	AMEC	978.692.9090
Ileen Gladstone	Project LSP	GEI Consultants, Inc.	781.721.4012
Mark Ensign	Project Manager	GEI Consultants, Inc.	781.721.4010
Nancy Potak	Data Validator	Potak	802.533.9206
Reza Tand	Laboratory Project Manager	Accutest	508.481.6200

**General Notes:**

1. LSP = Licensed Site Professional
2. QA = Quality Assurance



**Table 2**  
**GEI Standard Operating Procedures**  
 Tufts Street  
 Somerville, Massachusetts

Project Sampling SOPs				
SOP No.	SOP Title	Revision Date	Originating Organization	Modifications for Project Work
RE-001	Field Notebook	2/6/1995	GEI	None
RE-007	Chain-of-Custody	6/3/2001	GEI	None
RE-008	Analytical Data Review	2/6/1995	GEI	None
SA-005	Sample Handling	2/6/1995	GEI	None
SA-009	Air Sampling Using Summa® Canisters	2/20/2006	GEI	None
TE-001	VOC Field Screening	2/6/1995	GEI	None

**General Notes:**

1. Copies of the SOPs are presented in Appendix A.
2. Equipment needed is identified in the SOPs (Appendix A).



**Table 3**  
**Accutest Laboratory Equipment Preventative Maintenance**  
 Tufts Street  
 Somerville, Massachusetts

Instrument	Activity	Frequency
GC/MS (VOCs)	Check Trap and Column performance. This is monitored by checking the response factor of key components which indicate trap and column degradation and observing column bleed. Change trap or column if necessary. Check that gases have adequate supply to last until the following day. Change tanks if necessary. Check data file space on the data system.	As Needed
GC/MS (VOCs)	Check spit flow on GC. Check purge gas flow on the purge and trap systems. Adjust if necessary. Check Teflon ferrules on the purge and trap systems for wear. Replace if necessary. Check Teflon block on the autosampler systems for wear. Replace if necessary.	As Needed
GC/MS (VOCs)	The o-rings, Teflon block should be replaced and intake filters should be vacuumed.	As Needed
GC/MS (VOCs)	The vacuum pump oil should be changed.	As Needed
GC/MS (VOCs)	Clean the analyzer source. This will become necessary if a high background becomes apparent which is not attributable to column degradation or the system cannot meet BFB criteria. Replace the electron multiplier when the maximum gain no longer provides the required sensitivity. Replace the ion source filament.	As Needed

**General Notes:**

1. GC/MS = Gas Chromatography/Mass Spectrometer.
2. VOC = Volatile Organic Compounds.
3. Refer to Accutest SOPs and Quality Assurance Plan.



Table 4

Calibration and Corrective Action - Accutest Laboratory Equipment  
Tufts Street  
Somerville, Massachusetts

Instrument	Activity	Frequency	Acceptance Criteria	Corrective Action	Accutest TO-15 SOP Ref. (3)
GC/MS (VOCs)	Tune	Verify every 12 hours	Meets the tuning criteria for VOCs, Table 1 SOP	Fail - correct problem and rerun.	Table 1
GC/MS (VOCs)	Initial Calibration Curve	As needed	% RSD < 30 for all analytes of interest (2 cmpds may be >30<40)	Correct problem and recalibrate.	Section 14.2.9
GC/MS (VOCs)	Continuing Calibration	Verify every 24 hours	% Diff. ≤ +/- 30 for all analytes of interest	Correct problem, then recalibrate/reanalyze samples (as needed).	Section 14.3

General Notes:

- 1. GC/MS = Gas Chromatography/Mass Spectrometer.
- 2. VOC = Volatile Organic Compounds.
- 3. Accutest's TO-15 SOP is included in Appendix C.



**Table 5**  
**Field Quality Control Requirements**  
**Tufts Street**  
**Somerville, Massachusetts**

QC Sample	Frequency	Acceptance Criteria	Corrective Action
Duplicate Sample	2 per sampling round.	Concentrations of duplicate within +/-25% of original sample.	Reanalyze sample, Flag data and data report sheets, resample if needed.
Trip blank	1 per sampling round.	No analytes detected above reporting limit.	Reanalyze sample, Flag associated data and data report sheets, resample if needed.

**General Notes:**  
1. VOC = volatile organic compounds.



Table 6  
Accutest Laboratory Quality Control Requirements  
Tufts Street  
Somerville, Massachusetts

QC Sample	Frequency	Acceptance Criteria	Corrective Action
VOC			
Method Blank	Every 24 hours	All reported analytes below reporting limit.	Rerun Blank, Qualify results.
Duplicate	1 per analytical batch (maximum of 20 samples)	Duplicate precision must meet criteria of +/- (25 or in-house limits).	Reanalyze or footnote results as needed.
Surrogate recoveries	Every run (for VOCs)	Surrogate recovery must meet in-house limits.	Reanalyze samples or qualify results as needed.

General Notes:  
1. VOC = Volatile Organic Compound.  
2. LCS = Laboratory Control Spike.



Table 7

Reporting Limits, Accuracy, and Precision for Air  
Tufts Street  
Somerville, Massachusetts

VOC (GC/MS) Compound List	MCP-GW2 Background Indoor Air ppbv	Reporting Limit in Air Samples ppbv	Reporting Limit below published background?	Accuracy for Air (% R)	Precision for Air (% RPD)
Chloroethane	--	0.2	NA	In-House	25% or In-House
Chloroform	0.60	0.2	Yes	In-House	25% or In-House
Chloromethane	--	0.2	NA	In-House	25% or In-House
Carbon Tetrachloride	0.16	0.2	No	In-House	25% or In-House
1,1-Dichloroethane	NL	0.2	NA	In-House	25% or In-House
1,1-Dichloroethylene	--	0.2	NA	In-House	25% or In-House
1,2-Dichloroethane	--	0.2	NA	In-House	25% or In-House
trans-1,2-Dichloroethylene	--	0.2	NA	In-House	25% or In-House
cis-1,2-Dichloroethylene	--	0.2	NA	In-House	25% or In-House
Methylene Chloride	2.83	0.2	Yes	In-House	25% or In-House
1,1,1-Trichloroethane	5.41	0.2	Yes	In-House	25% or In-House
1,1,2,2-Tetrachloroethane	0.0014	0.2	No	In-House	25% or In-House
1,1,2-Trichloroethane	--	0.2	NA	In-House	25% or In-House
Tetrachloroethylene	1.60	0.2	Yes	In-House	25% or In-House
Trichloroethylene	--	0.2	NA	In-House	25% or In-House
Vinyl Chloride	NL	0.2	NA	In-House	25% or In-House

**General Notes:**

- Accuracy as measured by percent recovery and values presented in this table refer to acceptable LCS recoveries.  
Accuracy is also measured through the use of surrogate spikes.
- Precision is measured through the use of relative percent difference (RPD) between original and duplicate recoveries.
- NA = not applicable. Samples are not being collected for this analysis.
- MCP-GW2 Background Indoor Air concentrations from Massachusetts Department of Environmental Protection guidance memorandum, August 2002.
- ppbv = parts per billion volume.
- NL = Not listed.
- = no known DEP published background level.



**Table 8**  
**Surrogate Control Limits**  
**Tufts Street**  
**Somerville, Massachusetts**

Surrogate	Percent Recovery
4-Bromofluorobenzene	In-house

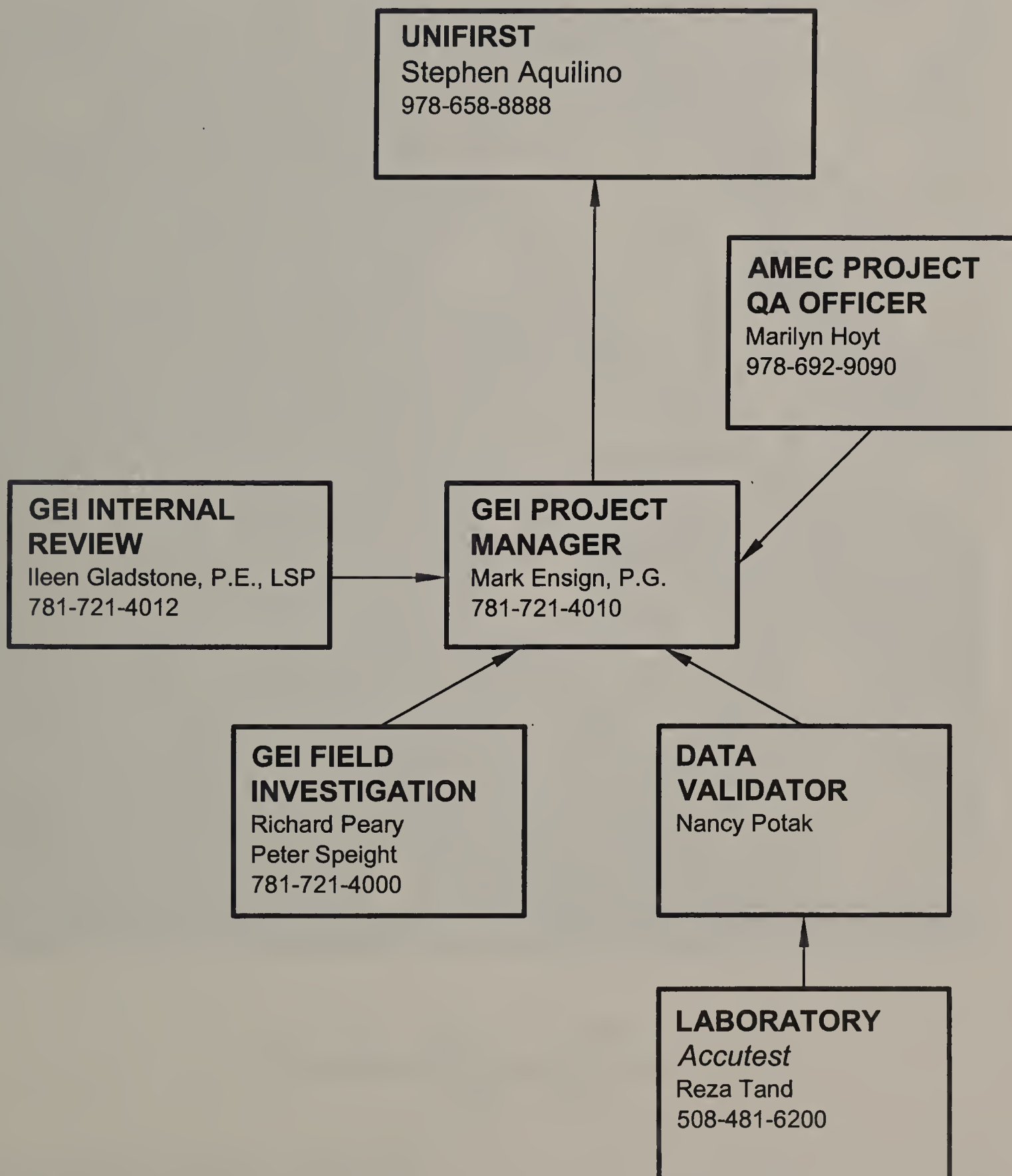
**General Notes:**

1. Accuracy measured as % recovery of surrogate compounds.
2. VOC = volatile organic compounds.









QAPP - Indoor Air Testing  
Tufts Street  
Somerville, Massachusetts

UniFirst Corporation  
Wilmington, Massachusetts



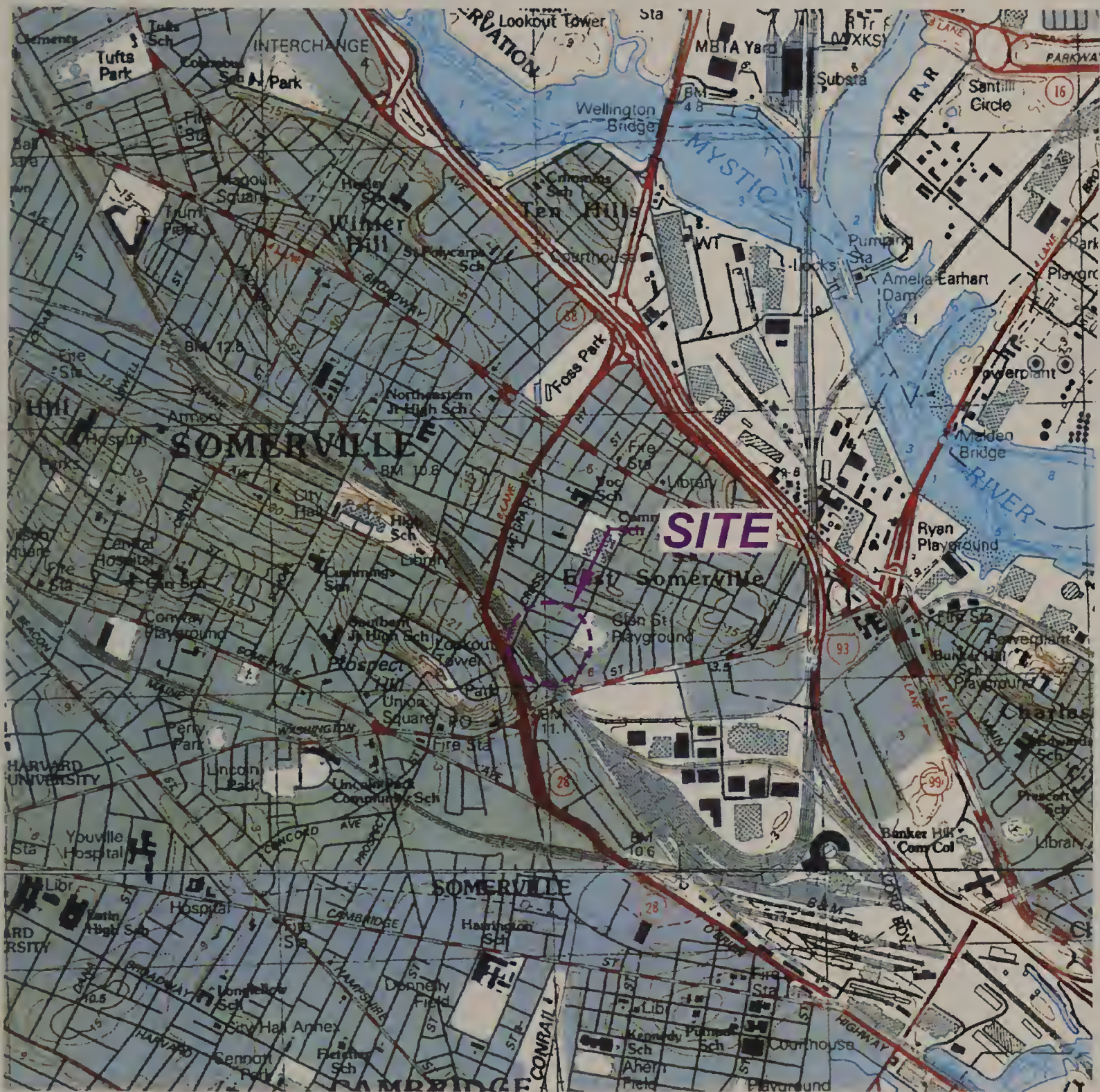
Project 045160

ORGANIZATIONAL  
CHART

April 2006

Fig. 1





0 1000 2000 4000 6000

SCALE, FEET

This Image provided by MassGIS is taken from  
U.S.G.S. Topographic 7.5 X 15 Minute Series  
Boston North, MA Quadrangle, 1985.  
Datum is National Geodetic Vertical Datum (NGVD).  
Contour Interval is 3 Meters.



MASSACHUSETTS  
QUADRANGLE LOCATION

QAPP - Indoor Air Testing  
Tufts Street  
Somerville, Massachusetts

UniFirst Corporation  
Wilmington, Massachusetts



Project 045160




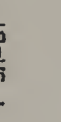
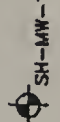
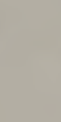
LOCATION MAP

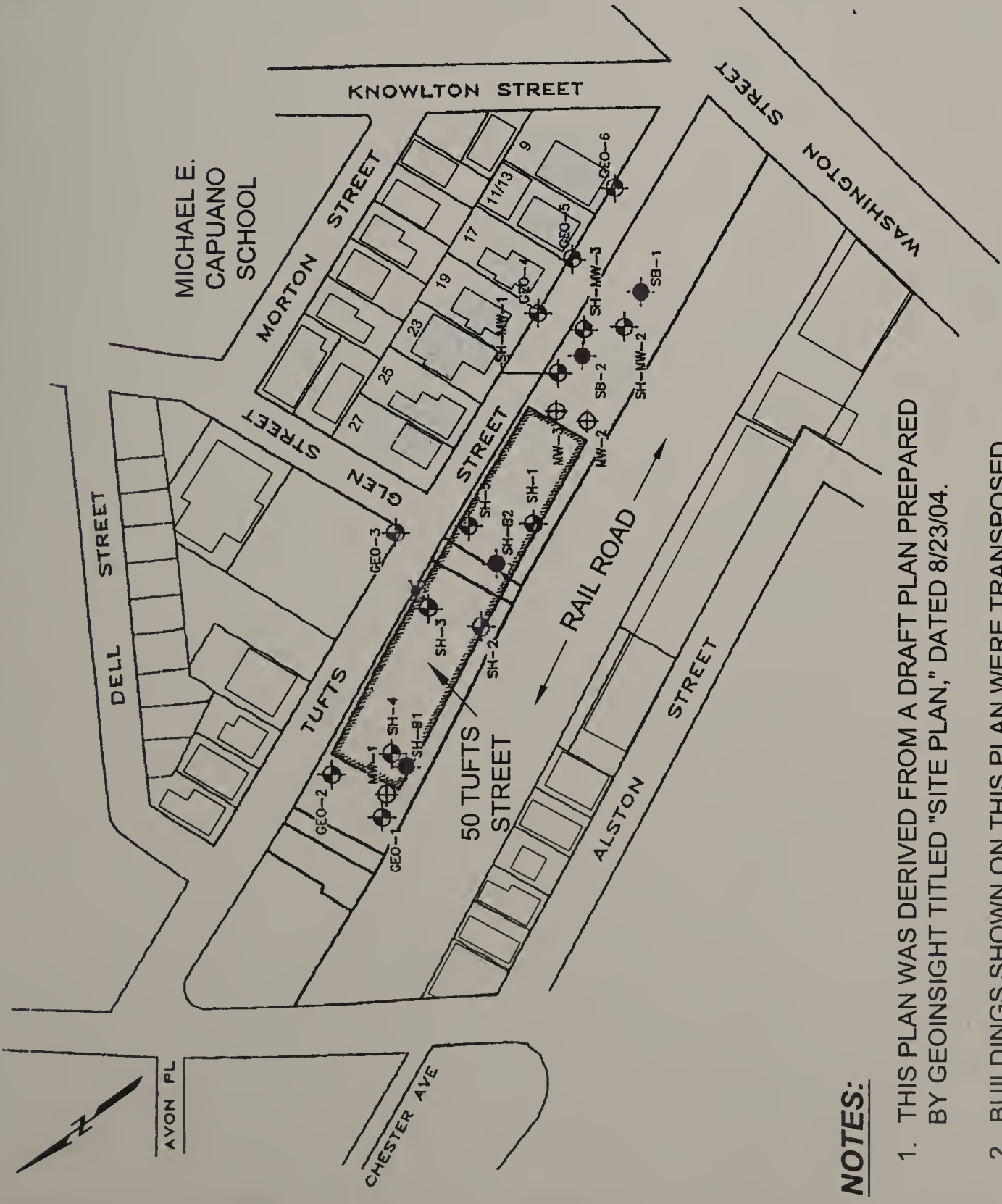
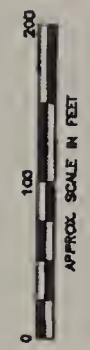
April 2006

Fig. 2



**LEGEND**

- Indoor Air Testing**
-  MONITORING WELLS INSTALLED UTILIZING GEOPROBE ADVANCEMENT METHODS BY ENVIRONMENTAL DRILLING, INC. OF STERLING, MASSACHUSETTS ON 6/21/02. BORING AND WELL CONSTRUCTION WERE OBSERVED AND LOGGED BY SHA PERSONNEL
  -  BORINGS ADVANCED UTILIZING GEOPROBE ADVANCEMENT METHODS BY ENVIRONMENTAL DRILLING, INC. OF STERLING, MASSACHUSETTS ON 6/21/02. BORING AND WELL CONSTRUCTION WERE OBSERVED AND LOGGED BY SHA PERSONNEL
  -  MONITORING WELLS INSTALLED UTILIZING 6" ID AUGER ADVANCEMENT METHODS BY ENVIRONMENTAL DRILLING, INC. OF STERLING, MA ON 7/3/02. BORING AND WELL CONSTRUCTION WERE OBSERVED AND LOGGED BY SHA PERSONNEL
  -  PRE-EXISTING MONITORING WELLS FOUND ON SITE BY SHA PERSONNEL
  -  MONITORING WELLS INSTALLED BY GEOINSIGHT PERSONNEL, AUGUST 2004.
  -  SOIL BORINGS INSTALLED



**NOTES:**

1. THIS PLAN WAS DERIVED FROM A DRAFT PLAN PREPARED BY GEOINSIGHT TITLED "SITE PLAN," DATED 8/23/04.
2. BUILDINGS SHOWN ON THIS PLAN WERE TRANSPOSED FROM THE CITY OF SOMERVILLE ASSESSORS MAP NO. 93, DATED JANUARY 3, 2001.

QAPP - Indoor Air Testing  
 Tufts Street  
 Somerville, Massachusetts  
 UniFirst Corporation  
 Wilmington, Massachusetts



PROPOSED  
 SAMPLING  
 LOCATIONS

Project 045160

April 2006

Fig. 3







# Appendix A

---

## Field Sampling SOPs



## FIELD NOTEBOOK

### Objective

The field notebook is intended to serve as a record of significant field activities performed or observed by GEI. The field notebook will serve as a factual basis for preparing field observation reports, if required, and reports to clients and regulatory agencies.

### Procedure

1. Use a separate bound notebook for each site/location/project number.
2. Write neatly using black or blue ink (or note if field conditions (i.e., cold or wet weather require use of pencil).
3. Write the project name, project number, and book number (i.e., 1 of 3) on the front cover. On the inside cover, identify the project name, project number, and "Return Book to" GEI's address.
4. Number all of the pages of the field book starting with the first entry.
5. Record activities as they occur.
6. Neatly cross out mistakes using a single line and initial them. Erasures are not permitted.
7. Sign or initial and date the bottom of every page with an entry. Cross out unused portions of a page.
8. Record the following information upon each arrival at the site:
  - a) Date/time/weather/project number
  - b) GEI personnel
  - c) Purpose of visit/daily objectives
9. Record conversations with: [Recommendation - If possible, record telephone numbers of individual contacts for the site in the field notebook.]
  - a) Contractors
  - b) Clients
  - c) Visitors (include complete names, title, affiliations, whenever possible).
  - d) GEI office staff

- e) Landowners (site or abutters)
- f) Note time of arrival and departure of individuals visiting the site.

10. Examples of the field information to be recorded includes and time of occurrences.

- a) General site work activities
- b) Subcontractor's progress
- c) Type and quantity of monitoring well construction materials used
- d) Use of field data sheets (i.e., boring logs, monitoring well sampling logs, etc.)
- e) Ambient air monitoring data
- f) Locations of sampling points
- g) Surveying data (including sketches with north arrows)
- h) Changes in weather
- i) Rationale for critical field decisions
- j) Recommendations made to the client representative and GEI PM.

11. Record the following information upon departure:

- a) Include a site sketch of conditions at the end of the day.
- b) Time
- c) Summarize work completed/work remaining
- d) Place a diagonal line through and sign portions of pages not used or skipped.

### Precautions

- Only record facts. Do not record opinions.
- Do not fail to record an observation because it does not appear to be relevant at that time.
- Identify conditions or events which could effect/impede your ability to observe conditions.
- Do not use spiral notebooks because pages can be easily removed.

### References

1. ASFE Model Daily Field Report (1991), ASFE, Inc.

### Attachment

Example Field Notebook



## CHAIN-OF-CUSTODY

### Objective

Due to the potential evidentiary nature of the samples collected during environmental investigations, sample possession must be traceable from the time of collection until delivery to an outside laboratory or disposal. A sample is under custody if:

- a) It is GEI's possession; or
- b) It is in GEI's view after being in GEI's possession; or
- c) It was in GEI's possession and then it was locked up to prevent tampering; or
- d) It is in a designated secure area. GEI facilities are designed secure areas.

### Procedures

1. Following sample collection, the sample container is labeled with the sample ID, the date and time of sample collection, and the sampler's initials (see *Sample Handling SOP*). Sample custody begins at this time.
2. Record the above information in the Field Notebook (see *Field Notebook SOP*).
3. Place the sample into a cooler with ice.
4. Complete the Chain-of-Custody (COC) form as illustrated in the attached example.
5. When the sample(s) are ready to be relinquished, the GEI employee in possession must sign and record the date and military time on the COC in the "Relinquished By" box.
6. If samples are being sent to the laboratory by courier or other shipping service, the first "Received By" box on the COC must be completed by GEI and must identify the shipping service (for example, GEI Courier or Federal Express).
7. Prior to sample shipment, the COC must be placed inside the cooler, and the cooler must be sealed with a signed COC seal.
8. If the sampler has hand delivered the samples to the laboratory, the

received box will be completed by the laboratory.

### **Precautions**

- If some samples on the COC prepared in the field are not being sent to the laboratory, you should prepare a new COC for the laboratory samples. The field COC should be marked "sample sent to laboratory" in the remarks section associated with each sample sent, initialed, and dated.
- The field notebook must document all GEI personnel who had custody of all or any of the samples on the COC. If the samplers will not be responsible for shipping the samples to the laboratory, the samples must be relinquished to the shipper and the COC signed and dated by the sampler and the shipper, even if both people are GEI personnel.

### **References**

1. NEIC Policies and Procedures Manual (October 1979), U.S. EPA (EPA-330/9-78-001-R).

## **ANALYTICAL DATA REVIEW**

### **Objective**

The overall objective of reviewing analytical data is to provide a quality control (QC) check on the data and the laboratories.

Review forms have been developed for each group of analyses, VOAs, semi-VOAs, pesticides/PCBS, TPH, metals, and inorganics. In addition, a cover sheet, which provides information for each data package has been created. Listed on the bottom of the cover sheet are footnotes developed from the USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic and Inorganic Analyses (November 1988) (DV guidelines). These footnotes are used to indicate how the end user should record and use the data in reports and tables.

### **Procedures**

1. Fill out all of the information listed on the cover sheet and select one data review form for each analysis.
2. Record the method used for analysis on the appropriate form.
3. Determine the holding time for each analysis per matrix. Mark the "criteria met" box with the appropriate response. If the criteria has not been met for any sample, record the sample ID in the "affected samples" box. Refer to the bottom of the cover sheet for the appropriate footnote and mark the box provided.
4. Review the surrogate recoveries for the appropriate analyses. Compare the surrogate recoveries to the limits noted in the criteria box. If surrogate recoveries are not met, refer to the attached DV guidelines for direction. If required, record the affected sample and associated qualifier.
5. Review the associated method blanks and any field or trip blanks submitted with the samples. If compounds are detected in any of the associated blanks, refer to the attached DV guidelines for direction. If required, record the affected sample and associated qualifier in the box provided.
6. Inspect the reporting limits for each sample, determine if the reporting limits have been elevated due to matrix interference, the presence of non-target analytes, or the high concentrations of target analytes. If the reporting limits have been elevated for any samples, note the sample ID and record the appropriate qualifier.

7. Review the QC data provided. This may include matrix spikes, laboratory duplicates, and blank spikes. Inspect the percent recovery and relative percent difference (RPD) for matrix and blank spike samples. Compare the recoveries and RPD values to the limits specified in each method. If the QC samples have not met the specified criteria, refer to the DV guidelines for direction. Assign the qualifiers to the data if required.
8. If issues related to the laboratory arise during review of the data, the reviewer must contact the laboratory and resolve the issues. The issues, resolution, and laboratory contact must be noted on the bottom of the cover sheet. The issues may include resubmittal of data sheets or QC data, explanations for sample dilutions or laboratory footnotes, inquires with regard to compounds detected or not detected.

### Precautions

- Data reviewers must be aware of any Quality Assurance Plans (QAPs) or special deliverable associated with the data. QC requirements in the QAP and deliverables may be different than QC requirements listed for each method.
- Do not speculate as to reasons for inconsistent data or unanticipated concentrations of compounds.
- Request laboratories to report below the reporting limit for common laboratory contaminants specified in DV Guidelines.
- Only the method blank should have compounds reported below the reporting limit.

### References

1. USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic and Inorganic Analyses (November 1988), U.S. Environmental Protection Agency.
2. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (November 1986), U.S. Environmental Protection Agency Department of Solid Waste, Washington, D.C.



## Data Review Cover Sheet

Data Reviewed By: \_\_\_\_\_

Date: \_\_\_\_\_

**Project Title:** \_\_\_\_\_

Project Number: \_\_\_\_\_

Laboratory: \_\_\_\_\_

Laboratory Job Number: \_\_\_\_\_

Chain of Custody - Present and Complete (Y/N) \_\_\_\_\_

All Requested Analysis Performed (Y/N):

**Case Narrative Present (Y/N):**

All data is reviewed based on the USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic and Inorganic Analyses (November 1988).

The following footnotes were used to qualify the project data: (Circle footnote letters)

- |           |   |
|-----------|---|
| A         | The result is estimated due to exceedence of holding times.   |
| B         | The reported result is attributed to laboratory contamination due to the presence of the chemical in the associated laboratory blank. |
| C+ / C -  | The result has a <u>high bias / low bias</u> due to surrogate recovery <u>above upper / below lower</u> control limits.               |
| D         | The reporting limit is elevated due to the presence of target or non-target analytes.   |
| F+ / F -  | The result has a <u>high bias / low bias</u> due to matrix spike recovery <u>above upper / below lower</u> control limits.            |
| G         | The result is estimated due to duplicate precision outside control limits.  |
| J         | The reported result is below the laboratory reporting limit and is estimated.   |
| K + / K - | The result has a <u>high bias / low bias</u> due to blank spike compound recovery <u>above upper / below lower</u> control limits.    |
| R         | The result is rejected due to gross exceedence of _____ criteria.   |

There were no qualifications (Circle if applicable)

Additional Comments:

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

  
**GEI** Consultants  
 Tier 2 Data Quality Review Form  
 Volatile Organics

Sample Prep Method: \_\_\_\_\_  
 Analysis Method: 8260B

Category	Criteria		Criteria Met?		Problem(s) Encountered	Affected Samples	Data Qualifier
			Y	N			
Holding Time & Preservation (from date sampled)	Solid - 14 d, MeOH Aq - 14 d, HCl Aq - 7 d, (unpreserved)						
Surrogate Recovery	Surrogate	Rec. Limits					
	1,2-DCE-d4	70-130					
	4-BFB	70-130					
	Tol-d8	70-130					
	DBFM	70-130					
Method Blank	All non-detect				Analyte Detected	Blank Action Lvl	
Trip Blank					Analyte Detected	Blank Action Lvl	
Field Duplicates Lab Duplicates	20% RPD - waters and solids						
Reporting Limits	Reporting Limits						
Lab Control Sample (LCS) / Blank Spike	Control Limits	70-130					
Matrix Spike Recovery	Control Limits	70-130					
Matrix Spike RPD	20% RPD - waters and solids						

DEP required limits are noted above. Laboratory-determined recovery/control limits may be more stringent.

Additional Comments:

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Tier 2 Data Quality Review Form  
Extractable Petroleum Hydrocarbons  
Method: MADEP EPH-98-1

Category	Criteria	Criteria Met?		Problem(s) Encountered	Affected Samples	Data Qualifier										
		Y	N													
Holding Time & Preservation (from date sampled)	Solid - 7 d, 4 deg. C Aq - 14 d, HCl															
PAH Quantitation Method	GC or GC/MS (circle one)															
Extraction	Surrogate															
Surrogate	OTP															
Recovery	COD															
Fractionation	Surrogate															
Surrogate	2-FB															
Recovery	2-BN															
Method Blank	All non-detect			<table border="1"> <thead> <tr> <th>Analyte Detected</th> <th>Blank Action Lvl</th> </tr> </thead> <tbody> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </tbody> </table>	Analyte Detected	Blank Action Lvl										
Analyte Detected	Blank Action Lvl															
Field Duplicates Lab Duplicates	50% RPD - waters and solids															
Reporting Limits	Reporting Limits															
Lab Control Sample (LCS)/ Blank Spike	Control Limits 40-140															
Matrix Spike Recovery	Control Limits 40-140															
Matrix Spike RPD	50% RPD - waters and solids															

DEP required limits are noted above. Laboratory-determined recovery/control limits may be more stringent.

Additional Comments:

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## SAMPLE HANDLING

### Objective

Sampling Handling involves the collection and shipping of environmental samples to a laboratory for chemical analysis. The overall objective of Sample Handling is to ensure:

- samples are properly labelled and documented;
- samples are properly preserved;
- samples are properly packaged; and
- samples are properly transported to laboratories.

### Procedures

1. Label all laboratory glassware prior to collecting samples. The label should have an adhesive and be placed on the jar or bottle, not on the cap.
2. Record the following information on the label and in the field notebook (See Field Notebook SOP): project number, sample identification (i.e., MW201 or SS-2), date and time of collection, samplers initials, and preservative, if present.
3. At each sampling location, samples must be collected in order of volatility, most volatile first. Samples collected for volatile analysis must be placed in sample containers immediately upon retrieval of the sample.
4. Aqueous samples for volatile analysis must be collected without air bubbles. Soil samples for volatile analysis should be compacted to eliminate as much headspace as possible. Other laboratory glassware should also be filled when possible.
5. If compositing of samples is performed in the field, specify basis for composite (i.e., volume, weight, spoon recovery, etc.) and record procedure for composing sample in the field book.
6. Once samples have been collected, place samples in a cooler with ice or a blue pack and start the chain-of-custody (See *Chain-of-Custody* SOP). See comment No. 1.
7. For shipping, individually wrap each sample bottle with "bubble packing" or suitable packing material and place the wrapped bottles in the cooler with sufficient packing material between samples to avoid breakage.
8. Place a layer of packing material above and below the sample bottles. Place blue ice packs or ice bags on top of the packing material. Fill the remaining space in the cooler with packing material to eliminate the possibility of vertical movement of samples.

9. Fill out the appropriate shipping or courier forms and attach to the top of the cooler. If necessary, place the proper shipping labels on the cooler. Place a custody seal on the cooler.

### Precautions

- At all times, follow safety procedures as defined in the site-specific Health & Safety Plan.
- Field personnel must be aware of analyses which have short holding times and schedule sampling events and shipping accordingly. Shipment of samples for analyses with short holding times must be planned in advance.
- In general, glassware for aqueous samples contains preservatives, i.e., HNO<sub>3</sub> or HCl. When collecting the sample, take care not to overfill the container, thus flushing the preservative out of the bottle.
- Never composite samples for VOCs in the field. Collect individual aliquots and direct laboratory to perform compositing.
- Collection of aqueous samples should not be performed over the opening of a monitoring well. Preservatives from overfilling, a marker pen or other objects could fall into the well.
- If the recharge volume for a monitoring well is low, completely fill all volatile vials and then collect the minimum sample volume required for each remaining analysis.
- During subsurface soil sampling, if the recovery from the split-spoon sample is inadequate, if appropriate, resample the bottom of the borehole to obtain proper sample volume.
- Laboratories will homogenize and test the contents of the sample container, unless directed otherwise. Samples should not contain rocks, twigs, leaves, etc. unless these materials are of interest.

### References

1. Manual of Ground-Water Quality Sampling Procedures (September 1981), U.S. EPA Office of Research and Development (EPA-600/2-81-160).
2. Soil Sampling Quality Assurance User's Guide (March 1984), U.S. EPA Office of Research and Development Environmental Monitoring Systems Laboratory, Cooperative Agreement CR 810550-01 (EPA-600/4-84-043).
3. Standard References for Monitoring Wells (January 1991), Massachusetts Department of Environmental Protection, DEP Publication # WSC-310-91.

Revision Date: February 20, 2006

## STANDARD OPERATING PROCEDURE FOR AIR SAMPLING USING SUMMA CANISTERS

### Objective

The purpose of this SOP is to describe the general procedures for collecting ambient air, indoor air, or soil gas samples using SUMMA canisters.

### General

Before sampling, establish the data collection objectives and consult guidance materials from the state where the sampling will be performed. Different states have different guidelines. Below are potentially relevant policies.

<b>Massachusetts</b>	<ul style="list-style-type: none"><li>Indoor Air Sampling and Evaluation Guide (MADEP, WSC Policy #02-430).</li><li>Characterizing Risks Posed by Petroleum Contaminated Sites (MADEP WSC-02-411).</li><li>Massachusetts Threshold Effects Exposure Limits (TELs) for Ambient Air (December 5, 1995 Memorandum).</li></ul>
<b>Minnesota</b>	<ul style="list-style-type: none"><li>Indoor Air Sampling at VOC Contaminated Sites: Introduction, Methods, and Interpretation of Results (January 8, 2004).</li></ul>
<b>New Hampshire</b>	<ul style="list-style-type: none"><li>Draft Vapor Intrusion Guidance (NHDES, April 8, 2005).</li></ul>
<b>New Jersey</b>	<ul style="list-style-type: none"><li>Draft Vapor Intrusion Guidance (NJ DEP, June 2005).</li></ul>
<b>New York</b>	<ul style="list-style-type: none"><li>Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH, Public Comment Draft, February 2005).</li></ul>
<b>Wisconsin</b>	<ul style="list-style-type: none"><li>Chemical Vapor Intrusion and Residential Indoor Air. Wisconsin Department of Health and Family Services (DHFS, February 13, 2003). <a href="http://www.dhfs.state.wi.us/eh/Air/fs/VI_prof.htm">http://www.dhfs.state.wi.us/eh/Air/fs/VI_prof.htm</a></li></ul>
<b>USEPA</b>	<ul style="list-style-type: none"><li>Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. Document EPA530-F-02-052 (2002). <a href="http://www.epa.gov/correctiveaction/eis/vapor.htm">http://www.epa.gov/correctiveaction/eis/vapor.htm</a></li></ul>

### Preliminary Steps for Indoor Air Sampling

1. Conduct an inventory of the building to be sampled. Consult the state guidelines for the inventory forms to be completed. An example pre-sampling field checklist is attached.
2. To the extent practicable, remove materials suspected of emitting volatile organic compounds (VOCs) or naphthalene from the test area. These materials

should be removed from the test area as far in advance of sampling as practicable, preferably at least 24-hours in advance of sampling.

3. If there are materials suspected of emitting VOCs or naphthalene and these materials can not be removed from the test area, screen the materials with a photo-ionization detector (PID), flame ionization detector (FID), or other screening instrument to evaluate the degree to which VOCs or naphthalene are being emitted by the material. Before proceeding with sampling, contact the project manager for additional guidance.
4. Follow state guidelines for building preparation prior to and during sampling.

### **Sampling Procedure**

1. Record data on the canister tag, in the field notebook, and on the sampling log sheet as applicable. An example log sheet is attached. Do not use a writing instrument that emits VOCs (e.g. a "SHARPIE" pen).
2. Prepare a diagram in the field notebook identifying each sampling location. Position canisters following these general criteria:
  - Air samples should be collected in the breathing zone for either an adult or child, as appropriate.
  - For indoor air samples, the sample should be collected from the middle of the room or close to a suspected source of intrusion of the contaminants of concern.
  - For outdoor (ambient) air samples, the flow regulator should be a "candy-cane" shape to prevent water from entering the SUMMA canister. The canister should be placed in a secure position and may be chained to a fence or other securing feature.
3. Label the tag attached to the canister with the sample ID number. In inclement weather, protect the tag by covering it with a zip lock bag.
4. For each canister and regulator, record in the field book and on the log sheet the: canister serial number (usually on the tag and marked on the canister), flow regulator serial number, sample ID, sampling location, sample date, and start and end time.
5. Remove the dust cap (usually a brass fitting) from the valve of the canister.
6. Confirm and record the initial canister vacuum.
  - Use either the vacuum gage on the flow regulator or a separate, laboratory supplied gage to measure the canister vacuum. If using a separate vacuum gage that is not part of the flow regulator, make sure the valve on the canister is closed before removing the gage.
  - Attach the flow regulator to the canister inlet, turning the threaded nut until it is hand tight. Use a wrench to tighten the flow regulator. The fittings on the flow regulator should be tight. To check this, pick up the canister and turn it clockwise or counter clockwise from the regulator. The regulator and the canister should turn as one unit. If the regulator

spins and the canister does not spin with it, then the valve has to be tightened.

- Compare this reading to the vacuum reported by the laboratory supplying the canister. The readings should be in general agreement and approximately -30 inches mercury (refer to laboratory chain-of-custody for the initial vacuum reading). Record the initial vacuum on the canister tag, in the field book, and on the log sheet. Remove the vacuum gauge.
7. To start sampling, open the canister valve fully, turning the valve counter clockwise 1½ to 2 turns. Record the start time and the vacuum on the canister tag, in the field book and on the log sheet. The vacuum should decrease slowly as the sample is collected.
  8. Photograph each sampling location and the surrounding area. Photograph each canister at the beginning of the test and at the end of the test before disturbing the canister. The purpose of photographing the canister at the beginning and end of the test is to obtain data that can be used to evaluate whether the canister was disturbed during the testing period.
  9. To end sampling, close the canister valve fully, turning the valve clockwise until it is hand tight. Record the end time and the final vacuum on the canister tag, in the field notebook, and on the log sheet. If the valve is not closed after sampling, the canister could sample more air after sampling has finished and the results may be compromised. For 6-liter canisters, the required final vacuum is between -5.0 inches of mercury and -0.5 inches of mercury. Contact the laboratory to determine the appropriate final sampling vacuum based on the size of the canister used and the duration of sampling.
  10. Disconnect the regulator from the canister, replace the dust cap and return both to the laboratory in the boxes they were shipped in. Prepare a specific air sampling chain-of-custody form to accompany the shipment.

## Equipment

The following equipment is typically used during sampling:

- SUMMA canister that is provided by the testing laboratory and sized to accommodate the sampling required.
- Flow regulator that is provided and adjusted by the laboratory to accommodate the sampling duration.
- Flow splitter provided by the laboratory for duplicate sampling (if applicable).
- Signs to be placed on the canisters that indicate air sampling in process with contact information.
- Camera, measuring tape, locks and chains, field notebook.

## QA/QC

1. If appropriate, an extra canister should be available for each sampling round in case of malfunction of one of the other canisters.
2. Collect a duplicate for every 20 samples. The duplicate should be collected in an area where contamination is known or suspected to be present. Field duplicates of air samples are collected using a splitter on the air intake. Remove the stainless tubing inlet from the flow regulator. Attach the flow regulator to each canister, then attach a branch of the splitter to each controller. Be sure to open the valve on both canisters at the same time.
3. A trip blank should be “collected” for every 20 samples. The trip blank is another canister that is not used for sampling and should have a custody seal on its inlet. The trip blank canister is removed from the shipping container, and transported to each location where sampling is occurring and then sent back to the laboratory unopened and with the custody seal intact.

### Attachments:

- Pre-sampling Field Checklist
- Sampling Checklist

N: 04516 QAPP - Air Monitoring-AIR SAMPLING SOP 01-31-06 mam.doc



# PRE-SAMPLING FIELD CHECKLIST FOR INDOOR AIR SAMPLING

Survey Completed by: \_\_\_\_\_ Date: \_\_\_\_\_

Site Name: \_\_\_\_\_ Case #: \_\_\_\_\_

## Part I - Occupants

Building Address: \_\_\_\_\_

Property Contact: \_\_\_\_\_ Owner / Renter / other: \_\_\_\_\_

Contact's Phone: home ( ) \_\_\_\_\_ work ( ) \_\_\_\_\_ cell ( ) \_\_\_\_\_

Building occupants: Children under age 13 \_\_\_\_\_ Children age 13-18 \_\_\_\_\_ Adults \_\_\_\_\_

## Part II - Building Characteristics

Building type: single-family residential / multi-family residential / office / strip mall / commercial / industrial

Describe building: \_\_\_\_\_

Number of floors - below grade: \_\_\_\_\_ (full basement / crawl space / slab) at or above grade: \_\_\_\_\_

Basement size: \_\_\_\_\_ ft<sup>2</sup> Basement floor: concrete / dirt / floating / other (specify): \_\_\_\_\_

Foundation type: finished basement / full basement / partial basement / crawl space / slab on grade

Foundation materials: poured concrete / cinder blocks / stone / other (specify) \_\_\_\_\_

Foundation integrity: no crack or open joints / moderate cracks or open joints / many cracks or open joints

Basement / slab floor: concrete; good integrity / concrete with cracks / earthen floor / carpet or flooring

Basement use: storage; infrequent use / recreation or living space / bedrooms / other (specify) \_\_\_\_\_

Type of ground cover around outside of building: grass / concrete / asphalt / other (specify) \_\_\_\_\_

Moisture conditions in basement: wet / damp / dry / other (specify) \_\_\_\_\_

Basement sump present? Yes/No Sump pump? Yes/No Standing water in sump? Yes/No Product in sump? Yes/No

Type of heating system (circle all that apply):

hot air circulation	hot air radiation	wood	steam radiation	hot water radiation
kerosene heater	electric baseboard	heat pump	other (specify): _____	

Type of ventilation system (circle all that apply):

central air conditioning	mechanical fans	bathroom ventilation fans
individual air conditioning units	kitchen range hood fan	other (specify): _____

Type of fuel utilized (circle all that apply):

Natural gas / electric / fuel oil / wood / coal / solar / kerosene / outside (fresh) air intake

Septic system? Yes / Yes (but not used) / No Irrigation/private well? Yes / Yes (but not used) / No

Building address: \_\_\_\_\_

Existing subsurface depressurization (radon) system in place?      *Yes / No*      and running? *Yes / No*  
Has the building been weatherized with any of the following:  
                                 insulation    /   storm windows / energy efficient windows    Other (specify): \_\_\_\_\_

Comments:

**Part III - Outside Contaminant Sources**

MADEP Comprehensive Site List (1000-ft. radius): \_\_\_\_\_

Other stationary sources nearby (gas stations, emission stacks, etc.): \_\_\_\_\_

Heavy vehicular traffic nearby (or other mobile sources): \_\_\_\_\_

**Part IV – Indoor Contaminant Sources – *Use additional sheets if necessary***

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor & room), and whether the item was removed from the building 48 hours prior to indoor air sampling event.

Potential Sources	Location(s)	Removed Prior to Sampling? (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents		
Oven cleaners		
Carpet / upholstery cleaners		
Other house cleaning products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners		
Fuel tank (inside building)	If Yes is, is there an odor near tank? <i>None / weak / strong</i>	NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring		NA
Recent painting in building?		NA
Hobbies - glues, paints, etc.		

Building address: \_\_\_\_\_

**Part V – PID Screening - Use additional sheets if necessary**

PID screening of annular space around utility pipes through basement wall / floor? *Yes / no / not accessible*

PID screening of cracks in wall/ floor and/or wall/floor interface: *Yes / no / not accessible / no cracks*

PID screening above space above drain sump? *Not applicable / Yes / no / not accessible*

Results of screening / comments :

**Part V – Miscellaneous Items - Use additional sheets if necessary**

Do any occupants of the building smoke? *Yes / No* How often? \_\_\_\_\_

Has anyone smoked within the building within the last 48 hours? *Yes / No*

Does the building have an attached garage? *Yes / No*

If so, is a car usually parked in the garage? *Yes / No*

Do the occupants of the building have their clothes dry-cleaned? *Yes / No*

When were dry-cleaned clothes last brought into the building? \_\_\_\_\_

Have the occupants ever noticed any unusual odors in the building? *Yes / No*

Describe (with location): \_\_\_\_\_

Any known spills of a chemical immediately outside or inside the building? *Yes / No*

Describe (with location): \_\_\_\_\_

Have any pesticides/herbicides been applied around the building foundation or in the yard/gardens? *Yes / No*

If so, when and which chemicals? \_\_\_\_\_

**Part IV – Indoor Contaminant Sources - (continued)**

Potential Sources	Location(s)	Removed Prior to Sampling? (Yes / No / NA)	Comments

**Part V – PID Screening - (continued)**

PID screening of annular space around utility pipes through basement wall / floor? *Yes / no / not accessible*

PID screening of cracks in wall/ floor and/or wall/floor interface: *Yes / no / not accessible / no cracks*

PID screening above space above drain sump? *Not applicable / Yes / no / not accessible*

Results of screening / comments :

**Part V – Miscellaneous Items - (continued)**

Do any occupants of the building smoke? *Yes / No* How often? \_\_\_\_\_

Has anyone smoked within the building within the last 48 hours? *Yes / No*

Does the building have an attached garage? *Yes / No*

If so, is a car usually parked in the garage? *Yes / No*

Do the occupants of the building have their clothes dry-cleaned? *Yes / No*

When were dry-cleaned clothes last brought into the building? \_\_\_\_\_

Have the occupants ever noticed any unusual odors in the building? *Yes / No*

Describe (with location): \_\_\_\_\_

Any known spills of a chemical immediately outside or inside the building? *Yes / No*

Describe (with location): \_\_\_\_\_

Have any pesticides/herbicides been applied around the building foundation or in the yard/gardens? *Yes / No*

If so, when and which chemicals? \_\_\_\_\_

## Instructions for Residents

(To be followed starting at least 48 hours prior to and during the sampling event)

- Do not open windows, fireplace openings or vents.
- Do not keep doors open.
- Do not operate ventilation fans or air conditioning.
- Do not use air fresheners or odor eliminators.
- Do not smoke in the house.
- Do not use wood stoves, fireplace or auxiliary heating equipment (eg - kerosene heater).
- Do not use paints or varnishes.
- Do not use cleaning products (eg - bathroom cleaners, furniture polish, appliance cleaners, all-purpose cleaners, floor cleaners).
- Do not use cosmetics, including hair spray, nail polish, nail polish remover, perfume, etc.
- Do not partake in indoor hobbies that use solvents.
- Do not apply pesticides.
- Do not store containers of gasoline, oil or petroleum-based or other solvents within the house or attached garage.  
(except for fuel oil tanks).
- Do not operate or store automobiles in an attached garage.



## AMBIENT AIR SAMPLING CHECKLIST

Sampling Location: \_\_\_\_\_

Date: \_\_\_\_\_

Sample ID: \_\_\_\_\_

Sampling personnel: \_\_\_\_\_

Summa Canister ID: \_\_\_\_\_

Flow Regulator ID: \_\_\_\_\_

Sample Type / Analysis Method: \_\_\_\_\_

Sampling Start Time: \_\_\_\_\_ am / pm

Sampling Finish Time: \_\_\_\_\_ am / pm

Did Summa Canister go to ambient pressure? Yes / No

Vacuum pressure reported by Laboratory: \_\_\_\_\_

Pressure gauge reading (Pre-opening): Flow Controller: \_\_\_\_\_ Separate gauge: \_\_\_\_\_

Pressure gauge reading (After sample collected): Flow Controller: \_\_\_\_\_ Separate gauge: \_\_\_\_\_

Environmental conditions (outside):

Before Sampling

After Sampling

Temperature

Barometric Pressure

Prevailing wind direction:

General weather conditions

Environmental conditions at sample location):

Before Sampling

After Sampling

Temperature

Barometric Pressure

PID readings at sample location (ppm)

Photographs taken before sampling? Yes / No If Yes, what time: \_\_\_\_\_ Taken by: \_\_\_\_\_

Photographs taken after sampling? Yes / No If Yes, what time: \_\_\_\_\_ Taken by: \_\_\_\_\_

Was the building aired out prior to sample collection? Yes / No If yes, how long? \_\_\_\_\_

Windows open? Yes / No Ventilation fans? Yes / No

Was there significant precipitation within 12 hours of (or during) the sampling event? Yes / No

Were any of the residents home during sampling? Yes / No If yes, provide detail: \_\_\_\_\_

Did any of the occupants NOT follow instruction for residents? Yes / No If yes, describe below

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process, as well as a sketch of the sampling location and sample setup indicating height of air intake from ground surface:

## VOC FIELD SCREENING

### Objective

The objective of field screening of soils is to obtain a site-specific measure of the relative concentrations of VOCs present in soil at a site. This information can be used: 1) to segregate soil based on degree of contamination, 2) to identify samples for quantitative analysis of VOCs, or 3) as a qualitative method to evaluate the presence or absence of VOCs in soil. A PID or FID instrument may be used.

### Procedure

1. Prior to a sampling event, the instrument must be calibrated to the appropriate standard and have an appropriate detector for the contaminants expected to be encountered at the site. The type of standard and detector used should be recorded in the field notebook.
2. Record background readings of atmospheric conditions in the work area while walking across the working area. The highest meter response should be recorded.
3. Half-fill a clean, glass jar with the sample to be analyzed using a clean trowel or soil spatula. Quickly cover the open top with one or two sheets of clean aluminum foil and screw on the cap to tightly seal the jar. Each jar should be labeled to indicate the location and depth from which the sample was collected.
4. Allow headspace development for at least 10 minutes. Vigorously shake the jar for 15 seconds both at the beginning and end of the headspace development period. When ambient temperatures are below 50°F, headspace development should occur, if possible, within a heated van or building.
5. After headspace development, remove the screw cap and expose the foil seal. Quickly puncture the foil seal with the instrument's sampling probe to a point about one-half of the headspace depth.
6. Following probe insertion through the foil seal, record the highest meter response as the jar headspace concentration. Maximum response should occur between 2 and 5 seconds after probe insertion.

### Precautions

- At all times, follow safety procedures as defined in the site-specific Health & Safety Plan.

- The various instruments may work poorly in the rain and below freezing temperatures. Under such conditions, it should be operated from within a heated vehicle or building.
- Care must be taken to prevent water or soil particles from entering the tip of the instrument probe. If this occurs, the tip should be removed and cleaned/dried before further use.
- While establishing background conditions and performing jar headspace screening, care should be taken to avoid extraneous VOC sources such as vehicle emissions which are not site related.
- Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture.
- Caution must be exercised when interpreting VOC headspace screening data. Results are dependent on site conditions. Screening results may differ by orders of magnitude from analytical testing results.
- Note that states may have specific procedures for field monitoring. In Massachusetts, the Massachusetts DEP requires that screening of gasoline-contaminated soil be performed in accordance with Attachment II of the DEP's policy #WSC-400-89 Management Procedures for Excavated Soils Contaminated with Virgin Petroleum Oils. Under this policy, two samples need to be taken at each sampling point and compared; replicate values should be consistent to plus or minus 20%. The instrument should be calibrated to read ppm as benzene with a 10.0 (+/-) eV lamp source. Instrument calibration should be checked/adjusted once every 10 samples, or daily, whichever is greater.

## References

1. Management Procedures for Excavated Soils Contaminated with Virgin Petroleum Oils (August 1990), Massachusetts Department of Environmental Protection, Policy #WSC-400-89.





## Appendix B

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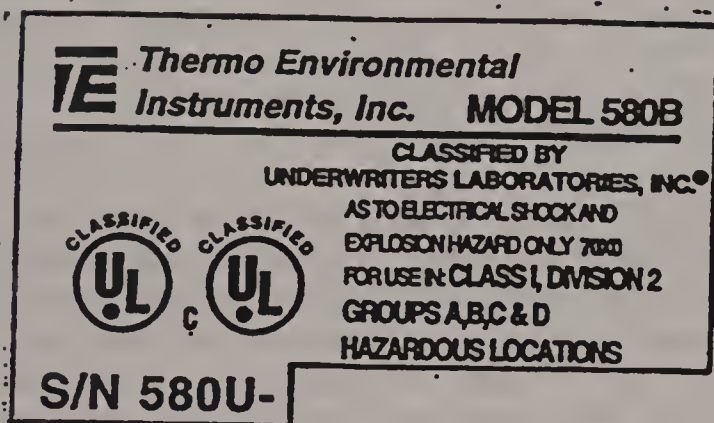
### PID Operation Manual



# MODEL 580B

ORGANIC VAPOR METER (OVM) / DATALOGGER

INSTRUCTION MANUAL  
P/N 16860



THIS EQUIPMENT IS SUITABLE FOR USE IN  
CLASS I, DIVISION 2, GROUPS (AS APPLICABLE)  
OR NON-HAZARDOUS LOCATIONS ONLY.

WARNING - EXPLOSION HAZARD - SUBSTITUTION  
OF COMPONENTS MAY IMPAIR SUITABILITY FOR  
CLASS I, DIVISION 2.

THERMO ENVIRONMENTAL INSTRUMENTS INC.  
8. WEST FORGE PARKWAY  
FRANKLIN, MASSACHUSETTS 02038

TELEPHONE: (508) 520-0430  
FACSIMILE: (508) 520-1460

Pressing the +/-INC switch will select the computer format and the 580B will advance to the baud rate screen (see below). Pressing the -/CRSR switch will cause the 580B to display:

PRINTER FORMAT  
+ = USE - = NO

Pressing the +/-INC switch will select the printer format and the 580B will advance to the baud rate screen (see below). Pressing the -/CRSR switch will cause the 580B to display the previous screen.

The baud rate screen will display the currently selected baud rate on the top line. The bottom line will display:

+ = USE - = NO

Pressing the +/-INC switch will cause the displayed baud rate to be selected and the 580B to show the selected format on the top line and the baud rate on the bottom line. Pressing the -/CRSR switch instead will cause the next lowest baud rate to be displayed.

## 2.8 BATTERY / CHARGER

The model 580B uses a 1.2 amp hour lead acid (gel cell) battery. There is protection circuitry potted directly on top of the battery. The battery is rechargeable with the charger provided with the instrument. The charger is regulated so that there is no danger of "over charging" the battery. It is suggested that the 580B be charged over the weekend (as well as each evening) during periods of heavy usage in order to ensure maximum battery charge.

## SECTION III

### ROUTINE MAINTENANCE

The routine maintenance of the 580B involves the calibration of the instrument, the cleaning of the lamp window, and the maintaining of charge on the battery. The following pages give instructions for routine maintenance. Figure 3.1 illustrates the detector assembly.

#### 3.1 LAMP INSERTION AND REMOVAL

##### 3.1.1 REMOVAL

NOTE: The 580B must be off while removing the lamp.

In order to remove the lamp the four screws which hold the case top and bottom together must first be loosened. The case bottom should be placed flat on the table and the top placed on its side next to the bottom.

The high voltage power supply is removed next by loosening the thumb screws on each side and then pulling the power supply towards the rear of the instrument (see figure 3.1). The lamp may now be removed by loosening the lamp nut.

##### 3.1.2 INSERTION

Insertion of the lamp is accomplished by performing the above tasks in the reverse order. The lamp should be placed flat against the o-ring and the lamp nut fastened down in order to create a proper seal. The high voltage power supply should then be inserted and the thumb screws fastened down. There are three pins protruding from the high voltage power supply which should fit snugly into connectors located beneath the detector. The lamp spring (mounted in the center of the high voltage power supply) should make contact with the lamp ring.

##### 3.1.3 LAMP CLEANING

On occasion the lamp should be removed for cleaning. Cleaning of the lamp is accomplished by cleaning the lamp surface of the UV lamp. The procedures for cleaning the different lamps are as follows:

##### 3.1.3.1 LAMP CLEANING METHOD FOR 10.6 eV OR LESS

This is accomplished by using the Aluminum Oxide scouring powder provided with the 580. First place a small amount of Aluminum Oxide scouring powder on the lens of the UV lamp. Next gently scour the lens surface with a soft tissue or cloth. Scour the lens in a rotary type motion.

After scouring the lens surface, gently blow the remaining powder from the lens. Follow this with an alcohol or acetone rinse, and then wipe dry with a soft tissue. The lamp is now able to be inserted into the detector.

#### 3.1.3.2 LAMP CLEANING METHOD FOR 11.7 eV OR MORE

This is accomplished by gently polishing the surface of the window with anhydrous alcohol on a cotton swab, followed by an anhydrous methanol or ethanol rinse, and then wiping dry with a soft tissue. Do not allow the alcohol to remain on the surface as it will leave a film. Stubborn films may require multiple cleanings for complete removal. The lamp is now able to be inserted into the detector.

MATERIAL LIST				
ITEM	PART NO.	DESCRIPTION	QTY	
1	5808-8003	DETECTOR SUB ASSY.	1	
2	5805-2010	NUT - LAMP (13507)	1	
3	5805-6019	PWR. SUPPLY ASSY. (13560)	1	
4	12082	NUT - KNURLED	2	
5	11929	U.V. LAMP 10.0	1	
6	5805-6035	DETECTOR WIRING ASSY. (13575)	1	
7	5808-8001	BASE HARNESS ASSY.	1	
8	4166	STRAIN RELIEF	1	
9	5805-6028	SIGNAL CABLE (13568)	1	
10	5814	1/4-40 X 1/4" BINDER HD. SCREW	2	
11				
12				
13	5510	TEFLON TUBING 1/8" 6.5' LG	1	
14	5588	1/4 INT. TOOTH STAR WASHER	1	
15	4417	UNION-2U-316	1	

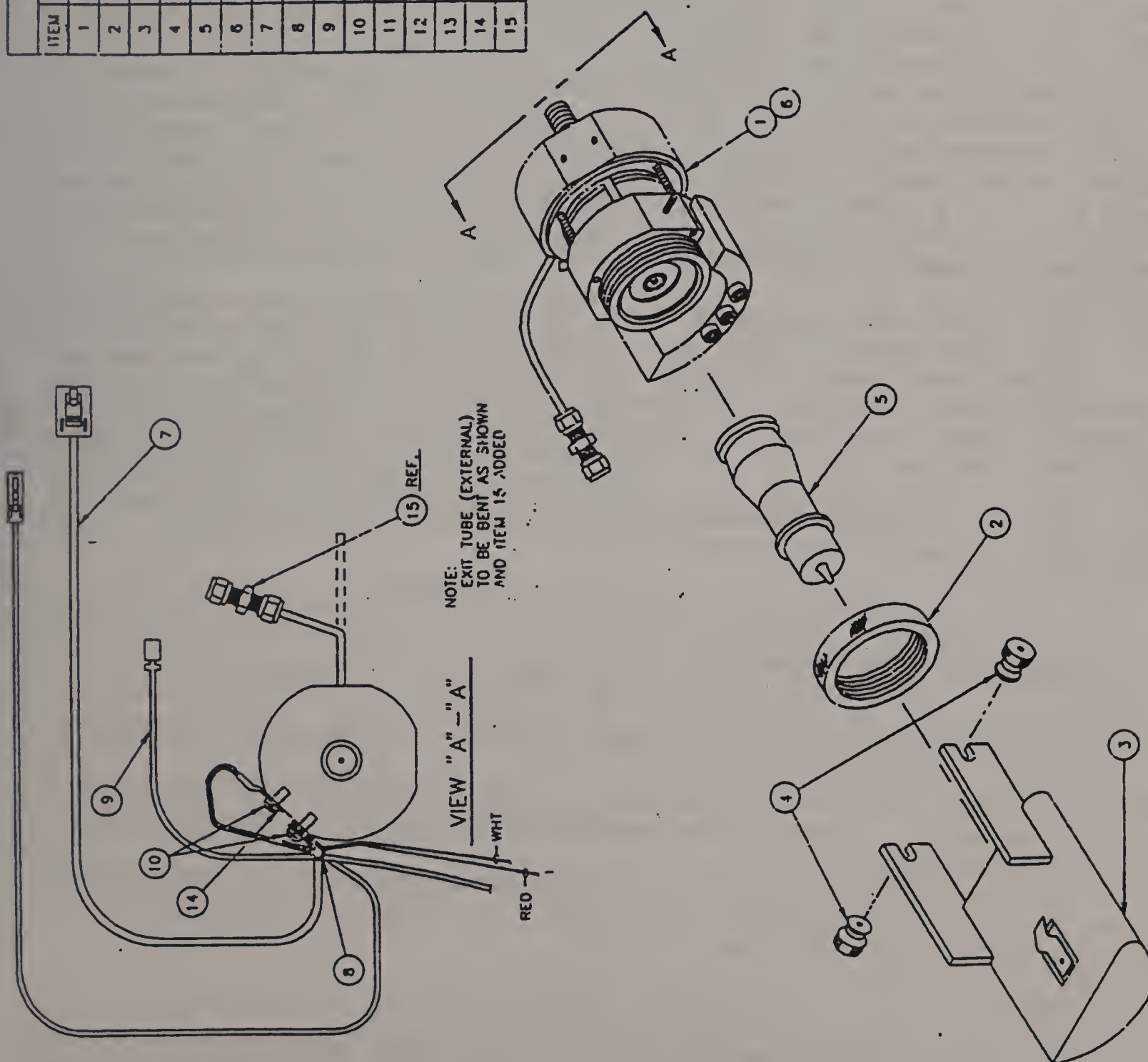


Figure 3.1  
Detector Assembly

### 3.2 CALIBRATION

NOTE: Chapter four should be read before calibrating the 580B in order to gain a better understanding of the concepts behind calibration of the 580B.

The following is a brief discussion of calibration as it relates to different lamps. One of the parameters in the Parameters mode (see Section 2.4) allows selection of lamp setting. The two types of lamps are the 10.0 eV and the 11.8 eV lamp. Whenever a new lamp is used the 580B must be calibrated. This is true even if the new lamp is the same type, e.g., the new and old lamp are both 10.0 eV. This is due to the fact that each lamp will have a slightly different sensitivity.

It is important to note that the 11.8 eV lamp will in general be less sensitive than the 10.0 eV lamp. This is true despite the higher energy level of the 11.8 eV lamp. The 11.8 eV lamp will however "see" certain gases which the 10.0 eV lamp will not. See Table E.1 for a list of common organic vapors and their associated ionization potentials. Any questions regarding the use of the 580B should be directed to Environmental Instruments Company Application Laboratory.

The 580B is quite simple to calibrate. A source of "zero air" and "span gas" are all that is needed to calibrate the 580B.

The zero air is introduced to the 580B in order to determine the "background" signal. The concentration of the span gas is then selected. The span gas is finally introduced to the 580B. The instrument makes all of the necessary calculations (including linearization) to arrive at a "calibration constant." When in the Run mode the signal is multiplied by the calibration constant in order to arrive at the current PPM.

SPAN PPM

$$\text{CALIBRATION CONSTANT} = \frac{\text{SPAN SIGNAL} - \text{ZERO SIGNAL}}{\text{SPAN SIGNAL} - \text{ZERO SIGNAL}}$$

$$\text{PPM} = (\text{SPAN SIGNAL} - \text{ZERO SIGNAL}) \text{ CALIBRATION CONSTANT}$$

NOTE: The PPM is then multiplied by the RESPONSE FACTOR before being displayed. Chapter four explains the use of response factors when calibrating.

Section 2.4.8 gives a detailed explanation of which buttons to press in order to calibrate the 580B. The flow chart at the back of this manual may also be helpful.

### 3.3 CHARGE

When there is a flashing "B" in the lower left corner of the display (while in the run mode) the battery is low. The battery is recharged by plugging the charger into the RUN/CHARGE plug at the rear of the 580B. The instrument runs while it is charging.

## SECTION IV

### CALIBRATION

#### 4.1 GENERAL

The Model 580B Organic Vapor Meter is indeed a quantitative instrument and can certainly be used as such. It makes use of the Photoionization Detection System using a lamp with an ionization energy of 10.0 eV which is standard in the Model 580B. Almost all organic materials will be ionized at this energy level. There are some organic materials, such as a few of the freons, methane, ethane and propane that are not ionized and thus will not be detected. The ionization potentials for the various organic materials will simply tell whether the material will be detected by the Photoionization Detector. It does not give any clue as to the sensitivity of the detector for that particular material. Certainly, different organic vapors will have different sensitivities. It is important to understand that the Model 580B does indeed sense most organic vapors and that its response to these different organic vapors will be different.

In this section of the manual, the aspects of calibrating the Model 580B for various vapors will be discussed. In the following section discussing applications, various ways of using the features of the Model 580B will be explained along with the various methods for calibration of the 580B. There will also be applications of the Model 580B in specific instances where the organic vapors or the mixtures of organic vapors are completely unknown. The 580B can be an extremely useful tool, even in areas such as those.

#### 4.2 FACTORY CALIBRATION TEST OF THE MODEL 580B

The Model 580B has been tested for calibration and linearity tested at the factory. The particular gas chosen for this calibration is isobutylene. The Model 580B has good response for isobutylene. Isobutylene standards prepared in air are relatively stable with time, undergoing no serious adsorption or reaction problems. The test information is included in the instrument packet. In addition to the above test a benzene standard is also run. It is important to note that the instrument was not calibrated. It was tested for calibration. Therefore, it should be calibrated by the operator before use.

#### 4.3 METHODS OF GENERATING CONCENTRATIONS OF VARIOUS MATERIALS IN AIR

This section is not intended to be all inclusive as far as the preparation of gas and vapor standards in air are concerned. Only those methods that have been found most practical for the calibration of the 580B are discussed here. There are basically two types of standards, cylinder and bag.

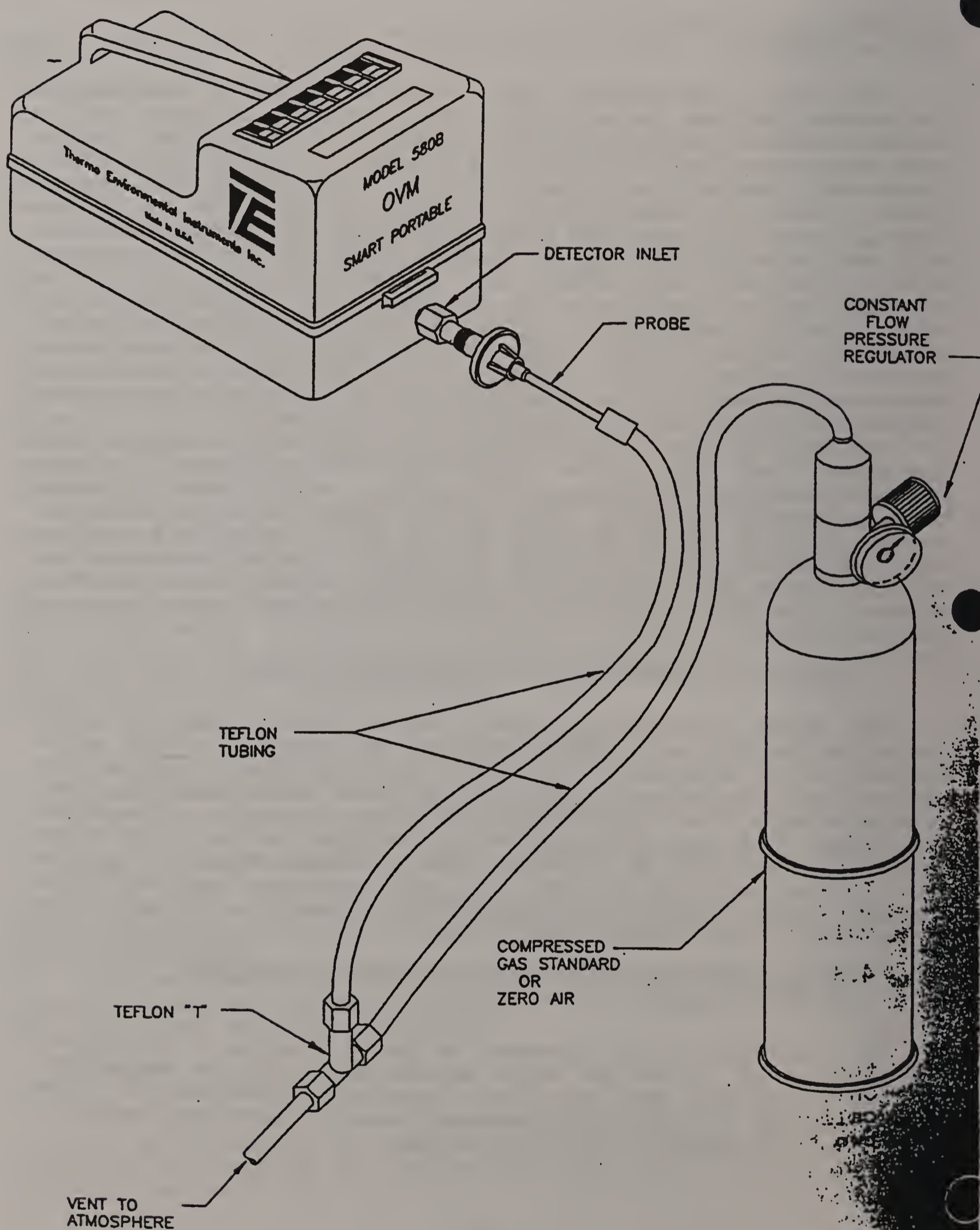


Figure 4.1  
Cylinder Calibration

### 4.3.1 CYLINDER STANDARDS

Certainly commercially available standard cylinders of gaseous materials in air offer the most convenient method of calibration. However, these are static standards. Standards prepared in this fashion in air for vapors of various organic liquids often show concentration reduction with time due to adsorption problems. In general, gases when mixed with air will maintain their concentrations with time since adsorption is generally not a problem.

However, some gases are sufficiently reactive that chemical reaction of the gas will cause a reduction of it in air. These precautions must be observed when using commercially prepared standards for calibration of the Model 580B. It is for this reason that isobutylene in air was chosen as a reference standard for factory calibration. TEI offers a cylinder standard which includes both zero and isobutylene standards. A constant flow pressure regulator sets the flow needed for calibration of the 580B. Figure 4.1 illustrates the physical calibration procedure. The inlet to the 580B is connected to the "T" as shown. It is important that this connection is tangent to the gas flow. The "T" is connected to the regulator on the standard cylinder. It is important that a length of tubing is attached to the "T" location. This prevents diffusion of ambient air into sample line. The regulator and tubing assembly will have to be moved between both the zero air and standard cylinder.

### 4.3.2 BAG STANDARDS (ISOBUTYLENE)

Bag standards can be prepared in a laboratory and in general are reasonable ways of calibrating the Model 580B. However, it is important that these standards be used shortly after their preparation to reduce the significance of any adsorption problems. Static standards prepared for calibration of the Model 580B are best prepared in collapsible plastic bags. This is opposed to a fixed volume container. The sampling rate of the 580B, which is 500 ml/min, requires an appreciable amount of sample. Even one minute's sampling out of a fixed container will remove 500 ml/min from it. This should not significantly reduce the pressure inside the container. Thus, the collapsible bag provides the best means as opposed to a fixed volume. A 5 gallon polyethylene bag is a convenient size to use for the preparation of static standard.

A tube is inserted into the opened end of the bag and the bag opening then sealed around the tube. The tube should have a cutoff valve or some means of closing the volume of the bag. The volume of air introduced into the bag must be measured. This is most conveniently measured by a wet test meter. However, a source of air flowing through a flow meter can be used if the flow can be held constant, then time is a measure of the volume of the air placed into the bag. All air is expelled from the bag by completely collapsing it prior to connection to the source of air.

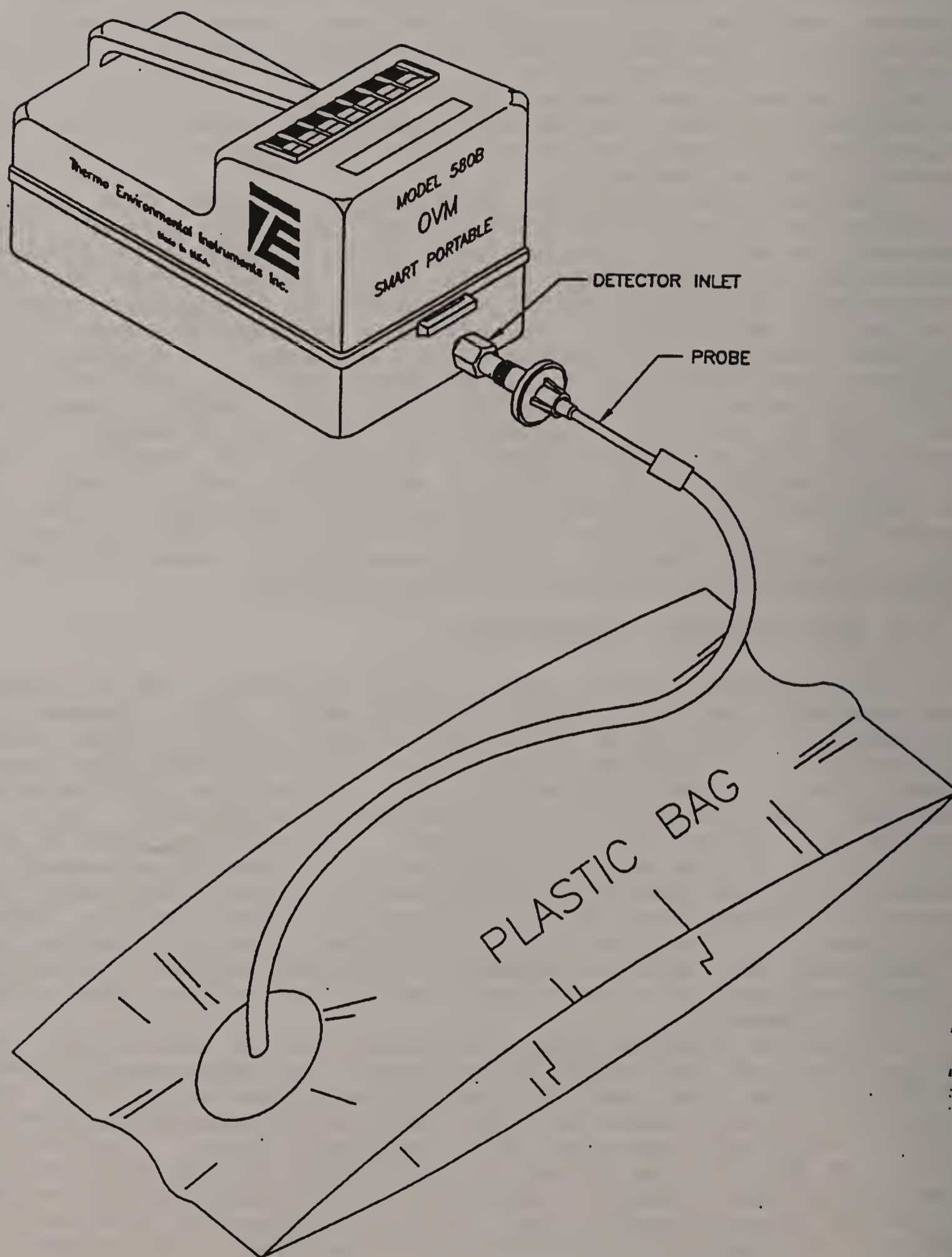


Figure 4.2  
Bag Calibration

It can then be connected to a wet test meter or flow meter via a short length of rubber tubing hooked to the plastic tube of the bag. The air flow is started into the bag at a rate of approximately 5L/min. A total of 10 liters is a convenient volume for a 5 gallon bag. This would mean approximately 2 minutes for filling the bag. Figure 4.2 illustrates the physical configuration needed to develop bag standards.

For gaseous samples, the trace organic will be added via a glass hypodermic syringe. The 1 cc Tuberculin syringe is a convenient size. For an isobutylene standard, the 1 cc syringe is flushed with pure isobutylene and then filled to the 1cc mark. While the air is flowing into the plastic bag, the short piece of rubber tubing is pierced by the needle from the 1 cc syringe and the plunger slowly depressed such that the 1 cc of isobutylene is added to the air flowing into the plastic bag. When 10 liters of air have been added to the plastic bag, the flow is immediately stopped and the valve on the tube or the closing clamp is applied to contain the air and isobutylene within the plastic bag. It is best at this stage of the procedure not to rely solely on the diffusion of isobutylene to form a uniform mixture inside the plastic bag. Slight kneading of the plastic bag will hasten the mixing of the isobutylene in air. The plastic tube from the bag is then connected to the probe on the Model 580B via a short length of rubber tubing and the valve on the plastic tube immediately opened. The Model 580B withdraws a sample from the bag at the sampling rate of 500 ml/min. Thus, 10 liters of sample in the bag will provide approximately 20 minutes. Certainly the calibration of the 580B can be accomplished in a shorter period of time. The concentration of isobutylene in ppm by volume will be equal to the sample size, which was 1 cc, divided by the volume of the bag in liters, which would be 10 liters, times 1000. In this particular instance, the concentration would be:

$$\text{Conc (ppm by Vol)} = \frac{1\text{cc Isobutylene} \times 1000}{10 \text{ L Air}} = 100 \text{ ppm}$$

#### 4.3.3 BAG STANDARDS (ORGANICS)

On occasion there is the need to prepare standards other than the normal calibration standard. As mentioned previously, isobutylene was chosen as a standard because of its stability. If other standards are to be used, it is best to develop a relation of the other standard to a standard of known stability like isobutylene. If this procedure is followed, a response factor can be developed by comparing the other organic standard to isobutylene this technique will be discussed in a later section. The following is a suggested technique for preparing other standards.

For organic materials, which are normally liquids at room temperature, the procedure is essentially the same except that an extremely small liquid sample is injected into the flowing air stream rather than the gas sample. This technique works well

only for relatively volatile organic materials. The flowing air stream must vaporize all of the material or the calculation will be off. If the material is not rapidly volatile in that flowing air stream, the liquid should be injected through the surface of the plastic bag. Immediately after withdrawing the needle, the hole in the plastic bag should be covered with a piece of plastic tape.

Again, significant kneading of the bag will hasten the evaporation of the sample and mixing of the vapor into the air to provide homogeneous samples. The introduction of this sample into the 580B is the same as before. The calculation of the concentration of the vapor in air is a two-step procedure whereby the small volume of liquid injected into the air stream and into the plastic bag is converted to a volume of vapor. This volume of vapor is then used in the same manner as the volume of gas in the case of isobutylene. The following equations apply:

$$\text{Volume Vapor (uL)} = \frac{\text{Liquid Volume (ul)} \times \text{Liquid Density} \times 24.45}{\text{Molecular Weight}}$$

The above equation gives the vapor volume at atmospheric pressure (760 torr) and 25° C (77F).

$$\begin{array}{l} \text{Then:} \\ \text{Concentration (ppm by Volume)} = \frac{\text{Vapor Volume (ul)} \times 1000}{\text{Air Volume (liters)}} \end{array}$$

The following is a sample calculation for benzene:

$$\text{Liquid Volume} = 2 \text{ ul}$$

$$\text{Benzene Density} = 0.879 \text{ g/cc}$$

$$\text{Molecular Weight Benzene} = 78.1$$

$$\text{Air Volume} = 10 \text{ Liters}$$

$$\text{Vapor Volume} = \frac{2 \times 0.879 \times 24.45 = 0.55 \text{ ul}}{78.1} \quad \text{Benzene Vapor}$$

$$\text{Conc} = \frac{0.55 \times 1000}{10} = 55 \text{ ppm (vol)}$$

The syringe used for the measurement of liquids in this particular instance is a small volume-type such as those manufactured by the Hamilton Company. A convenient size syringe is the 10 micro-liter volume.

## 4.4 580B CALIBRATION

The following procedure is applicable for both Cylinder and Bag Standards. The sequence requires both Zero gas and Span gas to be used. Span gas can be either contained as a cylinder or bag, in either case the exact concentration used must be known. This concentration will be entered to the 580 when the program provides its entry. With respect to Zero gas, there are several choices. Obviously a certified zero air standard in a cylinder presents no problem. Another choice would be to build a zero air standard in a bag. This can be simply accomplished with the set-up in Figures 4.1 and 4.2 using a charcoal scrubber to remove all the hydrocarbons present in the air. Charcoal does not absorb Methane; this does not cause a problem because the PID does not respond to it. Another approach which could be used in an emergency is to use room air unscrubbed.

This is acceptable if you know that there are no hydrocarbons present or they are exceptionally low in concentration. However, it is not recommended as a standard practice. The physical set up for cylinder calibration is illustrated in Figure 4.1; bag calibration in Figure 4.2.

### 4.4.1 CALIBRATION ROUTINE

- (A) Set-up calibration assembly with zero air cylinder or bag as described in Figures 4.1 and 4.2.
- (B) Model 580B set-up and zero calibration.

1. Power-up instrument using power plug.
2. Depress ON/OFF Key to ignite lamp and initiate sample pump.
3. Depress MODE/STORE Key.
4. Depress-/CRSR Key in response to LOG THIS VALUE? Prompt.
5. Depress-/CRSR Key to select Parameters Mode from the Main Menu.
6. Depress +/-INC Key to advance thru the Run Mode selection parameter prompt.
7. Depress +/-INC Key to advance thru the Auto Logging Mode selection parameter prompt.
8. Depress +/-INC Key to advance thru the Average Time selection parameter prompt.
9. Depress +/-INC Key to advance thru the Alarm Setting parameter prompt.
10. Depress +/-INC Key to advance thru Lamp Selection parameter prompt.
11. Depress +/-INC Key to advance thru Response Factor Setting parameter prompt.
12. Depress RESET Key to initiate calibration sequence.
13. Depress-/CRSR Key to decline restoration of the backup calibration.
14. Connect outlet of calibration tubing assembly to the Model 580B Detector Inlet as illustrated in Figure 4.2.
15. Introduce Zero Air to Model 580B by opening flow regulator.

16. Depress RESET Key to "Zero" Model 580B.
17. Close Flow Regulator.

(C) Span Calibration - assuming that the Span gas has a concentration of 250 ppm isobutylene the following procedure is followed:

18. Simultaneously Depress RESET and -/CRSR Keys to activate the movable cursor.
19. Repeat Step 18 until the cursor is at the ones place.
20. Simultaneously Depress RESET and +/INC Keys to increment the ones place value.
21. Repeat Step 20 until the ones place value reads 0.
22. Repeat Step 18 to move cursor to the tens place.
23. Repeat Step 20 until the tens place value reads 5.
24. Repeat Step 18 to move the cursor to the hundreds place.
25. Repeat Step 20 until the hundreds place value reads 2.
26. Repeat Step 18 to move the cursor to the thousands place.
27. Repeat Step 20 until the thousands place value reads 0.
28. The LCD should now read:

SPAN PPM = 0250  
"+" TO CONTINUE

29. Depress +/INC to accept the span conc. value.
30. Connect isobutylene cylinder (250 ppm) to calibration tubing assembly.
31. Connect outlet of calibration tubing assembly to the Model 580B Detector Inlet.
32. Introduce isobutylene standard to Model 580B by opening flow regulator.
33. Reset key to "CALIBRATE" Model 580B.
34. Close Flow Regulator.
35. Depress +/INC. Key in response to "RESET" TO CALIBRATE message.
36. Depress MODE/STORE to return to the Run Mode.

The instrument has been calibrated and is ready to make measurements.

#### 4.5 DETERMINATION OF RESPONSE FACTORS

As mentioned above, the Model 580 can be calibrated with isobutylene but be set to read correctly, the concentration of another substance. This is done by using the Response Factor that is set in the parameter routine. The default for the response factor is 1.0. The Response Factor is the number that is multiplied by the measured concentration to obtain the correct concentration of the measured component. If the chemical to be measured is less sensitive on a PID than the standard, (usually isobutylene) then the Response Factor is greater than 1.0. If it is more sensitive than the standard then the Response Factor is less than 1.0.

The reason for a Response Factor is practicality. If it is

know that the sample to be measured contains only benzene and therefore the user would like to read benzene concentration directly, there are two approaches. The user could make a bag standard daily of benzene vapor in air and calibrate the 580 directly. Or the Response Factor could be used. In the latter case a bag with benzene is made only once for comparison to a cylinder of a stable standard (such as isobutylene). Then daily, the Model 580 is calibrated with the cylinder standard; a simple operation compared to the work of preparing a bag standard.

As an example, if the bag containing 55 ppm benzene in air as prepared above were measured in a 580 calibrated against isobutylene, the concentration might have been read as 91 ppm. thus the 580 is more sensitive for benzene than for isobutylene.

The Response Factor can now be calculated as:

$$\text{Response Factor (RF)} = \frac{\text{Factor STD Concentration}}{\text{580 Reading of Factor STD}}$$

$$\text{RF} = 55/91 = 0.604$$

When 0.60 is entered into the 580 as the Response Factor, the 580 will read 55 ppm for the bag.

Now the 580 need only be calibrated using an isobutylene standard and a Response Factor of 0.60 to correctly respond to benzene.







## Appendix C

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### Accutest Laboratory SOPs



**ACCUTEST LABORATORIES  
STANDARD OPERATING PROCEDURE**

FN: MMS294-04  
Pub. Date: 4/26/04  
Rev. Date: 2/21/06  
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Lab Manager: Doug Yargeau

QA Officer: Mark Warren

**TITLE: Air Analysis by TO-15**

**TEST METHOD REFERENCE:** USEPA METHOD TO-15, 2<sup>nd</sup> Edition, January, 1999, Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GCMS)

**REVISED SECTIONS:** 3.1, 6.2, 7.1, 7.5, 7.12 (added), 8.4, 12.2.4, 14.2.1, 14.3.2, 14.6.4 (removed old section), 14.6.4, 14.8.8, removed old sections 14.8.3 and 14.8.4, 16.4.1, 16.5, 16.6.2, 16.6.3, 20.6, Removed the compound list table. Removed Tedlar bag analysis reference

## **1.0 SCOPE AND APPLICATION**

- 1.1 This method is for the analysis of volatile organics on whole ambient air samples collected in summa canisters. This procedure is applicable to EPA method TO-15 as the cryofocusing technique can trap a wide range of polar and non-polar compounds. Refer to Table 4 for a listing of compounds reported by this method.

## **2.0 METHOD SUMMARY**

- 2.1 A whole air sample collected in a summa passivated canister or Restek "Silcocan", is concentrated by adsorption and cryofocusing and introduced into a GC/MS for target compound analysis. Tedlar bags are not recommended by this procedure due to short holding times and compound instability.
- 2.2 The GC/MS is calibrated with a minimum 5 level curve with quantitation performed by internal standard technique. Standards are purchased as commercial certified gas standards and dynamically diluted into working calibration standards. Utilization of certified gas standards is the recommended approach to calibration and may be mandated by certain air certification programs or contracts.
- 2.3 A nominal sample volume of 400cc is used and adjusted if necessary based on dilutions and/or canister pressurization. Air is drawn out of a canister and trapped on a glass bead trap, tenax trap and cyrofocused prior to introduction into the GC/MS. The GC oven is temperature programmed to separate the compounds of interest with detection by a mass selective detector.
- 2.4 This method is applicable to the compounds listed on Table 5 which, are routinely calibrated.
- 2.5 The Method Detection Limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero. The RL (Reporting Limit) for an individual compounds is 0.05ppbv (3 compounds), 0.2ppbv and 0.5ppbv (2 compounds) which, is the low calibration standard.

# ACCUTEST LABORATORIES

## STANDARD OPERATING PROCEDURE

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### 3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

- 3.1 The reporting limit (RL) is based on the lowest calibration standard. RL's may vary depending on matrix difficulties, sample volumes or weights, and percent moisture. Detected concentrations below this concentration cannot be reported without qualification. Print out Compound List Report from LIMS for the current reporting limits.
- 3.2 The Method Detection Limit (MDL) represents the lowest reportable concentration of an individual analyte that meets the method qualitative identification criteria.
- 3.3 Method Detection limits (MDLs) are experimentally determined using the procedures described in 40 CFR, Part 136, Appendix B. Actual reported MDLs incorporate the sample volume analyzed and sample dilutions if needed, which may cause MDL variations from sample to sample.
- 3.4 In general, MDLs are determined through the analysis of at least 7 replicate blank spikes (using the same procedures for sample analysis). The MDL is calculated by multiplying the standard deviation of the replicate concentrations by the appropriate Student's t value (3.143 for 7 replicates). If more than 7 replicates are analyzed refer to 40 CFR, Part 136, Appendix B for the appropriate student's t value. MDLs are determined initially (prior to analysis), on an annual basis, and after major maintenance to equipment.
- 3.5 Current MDLs are entered into the LIMS, and can be viewed by printing out the compound list from LIMS. Additionally, MDLs are reported on the result page upon client request. Current MDL studies are filed with Quality Assurance. Obsolete MDL studies are archived with the QA files. Electronic MDL data is found in the annual "MDL" folder on the QA server (LINUXMA1).
- 3.6 Refer to the Procedure for Developing Detection Limits SOP (MQA245) for additional procedural detail.

### 4.0 DEFINITIONS

- 4.1 ALIQUOT - a measured portion of a sample, or solution, taken for sample preparation and/or analysis.
- 4.2 BATCH - A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20 (or 10 for certain methods), then each group of 20 samples (or 10 samples for certain methods) or less will all be handled as a separate batch.
- 4.3 CALIBRATION - the establishment of an analytical curve based on the absorbance, emission intensity, or other measured characteristic of known standards. The calibration standards must be prepared using the same type of acid or concentration of acids as used in the sample preparation.
- 4.4 CALIBRATION STANDARDS - a series of known solutions used by the analyst for calibration of the instrument (i.e., preparation of the analytical curve).

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- 4.5 CALIBRATION FACTOR (CF) - a measure of the gas chromatographic response of a target analyte to the mass injected. The calibration factor is analogous to the Relative Response Factor (RRF) used in the Volatile and Semivolatile fractions.
- 4.6 CONTINUING CALIBRATION – analytical standard run every 24 hours to verify the initial calibration of the analytical system.
- 4.7 CONTAMINATION - a component of a sample or an extract that is not representative of the environmental source of the sample. Contamination may stem from other samples, sampling equipment, while in transit, from laboratory reagents, laboratory environment, or analytical instruments.
- 4.8 FIELD SAMPLE - a portion of material to be analyzed that is contained in single or multiple containers and identified by a unique sample number.
- 4.9 HOLDING TIME – the elapsed time expressed in days from the date of sampling until the date of its analysis.
- 4.10 INTERFERENTS – substances which affect the analysis for the analyte of interest.
- 4.11 GAS CHROMATOGRAPH (GC) - the instrument used to separate analytes on a stationary phase within a chromatographic column. The analytes are volatilized directly from the sample (VOA water and low-soil) volatilized from the sample extract (VOA medium soil), or injected as extracts (SVOA and PEST). In VOA and SVOA analysis, the compounds are detected by a Mass Spectrometer (MS). In PEST analysis, the compounds are detected by an Electron Capture (EC) detector. In the screening procedure (all fractions), the Flame Ionization Detector (FID) is used as the detector.
- 4.12 INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the mass spectrometer or electron capture detector to the target compounds.
- 4.13 INITIAL CALIBRATION VERIFICATION – analysis of a check standard from a second source (either vendor or lot) from the initial calibration standards to verify the initial calibration.
- 4.14 INTEGRATION TIME RANGE - the retention time at the beginning of the area of integration to the retention time at the end of the area of integration.
- 4.15 INSUFFICIENT QUANTITY - when there is not enough volume (air) to perform any of the required operations: sample analysis.
- 4.16 MATRIX - the predominant material of which the sample to be analyzed is composed. For the purpose of this SOP, a sample matrix is either water or soil/sediment. Matrix is not synonymous with phase (liquid or solid).
- 4.17 MATRIX EFFECT - in general, the effect of a particular matrix (water or soil/sediment) on the constituents with which it contacts. This is particularly pronounced for clay particles which may adsorb chemicals and catalyze reactions. Matrix effects may prevent extraction of target analytes, and may affect surrogate recoveries. In addition, non-target analytes may be extracted from the matrix causing interferences.

**ACCUTEST LABORATORIES  
STANDARD OPERATING PROCEDURE**

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- 4.18 **MATRIX DUPLICATE** - a second aliquot of the same matrix as the sample that is analyzed in order to determine the precision of the method.
- 4.19 **METHOD BLANK** - an analytical control consisting of all reagents, internal standards, and surrogate standards (or SMCs for VOA), that is carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background, and reagent contamination.
- 4.20 **PERCENT DIFFERENCE (%D)** - As used in this SOW and elsewhere to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference).
- 4.21 **RELATIVE PERCENT DIFFERENCE (RPD)** - As used in this SOP to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. In contrast, see percent difference.
- 4.22 **RELATIVE RESPONSE FACTOR (RRF)** - a measure of the relative mass spectral response of an analyte compared to its internal standard. Relative Response Factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples. RRF is determined by the following equation:

$$RRF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

Where,

A = area of the characteristic ion measured  
C = concentration, or amount (mass)  
is = internal standard  
x = analyte of interest

- 4.23 **RELATIVE RETENTION TIME (RRT)** - the ratio of the retention time of a compound to that of a standard (such as an internal standard).

$$RRT = \frac{RT_c}{RT_{is}}$$

Where,

RT<sub>c</sub> = Retention time for the volatile target or surrogate compound in continuing calibration.  
RT<sub>is</sub> = Retention time for the internal standard in calibration standard or in a sample.

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- 4.23 **RESPONSE** - or Instrumental Response: a measurement of the output of the GC detector (MS, EC, or FID) in which the intensity of the signal is proportionate to the amount (or concentration) detected. Measured by peak area or peak height.
- 4.24 **SURROGATES** (Surrogate Standard) – for volatiles, semivolatiles and pesticides/Aroclors, compounds added to every blank, sample, matrix spike, matrix spike duplicate, and standard; used to evaluate analytical efficiency by measuring recovery. Surrogates are brominated, fluorinated, or isotopically labeled compounds not expected to be detected in environmental media.
- 4.25 **TWENTY- FOUR HOUR TIME PERIOD** - The twenty-four (24) hour time period for GC/MS system instrument performance check, standards calibration (initial or continuing calibration), and method blank analysis begins at the moment of injection of the DFTPP or BFB analysis that the laboratory submits as documentation of instrument performance. The time period ends after 24 hours have elapsed according to the system clock. For pesticide/Aroclor analyses performed by GC/EC, the twelve hour time period in the analytical sequence begins at the moment of injection of the instrument blank that precedes sample analyses, and ends after twelve hours have elapsed according to the system clock.
- 4.26 **RETENTION TIME (RT)** - the time a target analyte is retained on a GC column before elution. The identification of a target analyte is dependent on a target compound's retention time falling within the specified retention time window established for that compound. Retention time is dependent on the nature of the column's stationary phase, column diameter, temperature, flow rate, and other parameters.

## **5.0 HEALTH & SAFETY**

- 5.1 All safety practices must be followed as outlined in the Accutest Laboratories Employee Safety Handbook and Chemical Hygiene Plan. Safety glasses, gloves, and lab coats must be worn. All samples, solutions, and extracts must be treated as unknown and potentially hazardous.
- 5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level.
- 5.3 Releasing pressurized summa canisters must be performed under a ventilation hood.

## **6.0 HOLDING TIME & PRESERVATION**

- 6.1 28 days for summa canister.
- 6.2 Summa Canisters are stored at ambient temperature.

## **7.0 EQUIPMENT AND MATERIALS**

- 7.1 Hewlett Packard 6890 GC with 5973 MSD, Agilent 6890 GC with 5975 MSD.
- 7.2 PC based Hewlett Packard Chemstation with Enviroquant software.

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- 7.3 Entech model 7016CA 16-position canister autosampler.
- 7.4 Entech model 7100 pre-concentrator.
- 7.5 Entech model 4600 Dynamic Standards Diluter equipped with a 5000 sccm (for dilution gas) and two 50sccm (for standard) flow controllers.
- 7.6 30"Hg-30psig "NIST" traceable pressure/vac gauge, accurate to 0.25%, for sample receipt check and pressurization, if necessary.
- 7.7 6 liter certified (see canister cleaning SOP) passivated summa canisters or silcocans evacuated to under 0.05mm Hg.
- 7.8 Various gas tight syringes with point #5 style needles for direct injections.
- 7.9 Various liquid syringes for static dilution standard prep.
- 7.10 Various swagelok fittings.
- 7.11 Syringe adapters for summa canisters if manual injection or dilution needed.
- 7.12 Lab-Line L-C ovens.

## 8.0 STANDARDS AND REAGENTS

The manufacturer brands listed may be substituted with equivalent standards. Refer to table 5 for a list of compounds in the TO-14 reporting list, TO-15 reporting list, and add-on compounds.

- 8.1 Spectra Gases certified internal/surrogate gas standard at the following concentrations.

- Bromochloromethane 40ppbv
- 1,4-Difluorobenzene 40ppbv
- Chlorobenzene-d5 40ppbv
- 4-bromofluorobenzene 20ppbv

- 8.2 Spectra Gases certified 1ppmv TO-15 stock gas standard.
- 8.3 Spectra Gases certified 1ppmv second source TO-15 stock gas standard (for LCS)
- 8.4 Absolute Standards 1000 ug/ml naphthalene standard in methanol (varies depending on vendor).
- 8.5 Reagent grade organic free water.
- 8.6 Zero grade gases:
  - Helium
  - Nitrogen Dewar
  - Zero air

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### 9.0 INTERFERENCES

- 9.1 High CO<sub>2</sub> samples such as landfill gas may freeze and restrict flow on the traps causing reduced sample volume.
- 9.2 Common laboratory solvents such as methylene chloride, ethanol, hexane, iso-propanol, freon-113 and acetone may be detected at low level concentrations. The values qualified with a "B" if they are also detected in the method blank.

### 10.0 STATIC DILUTION STANDARD PREPARATION

This technique should only be used when commercially prepared standards are not available. These custom methanol based standards are purchased commercially.

10.1 Absolute Standards Naphthalene 1000ug/ml in methanol.

10.2 Intermediate Naphthalene methanol standard at 210ug/ml.

10.2.1 Dilute 210ul of the 1000ug/ml stock standard in methanol to a 1ml final volume.

10.3 40ppbv naphthalene gas standard – Option A

10.3.1 Inject approximately 80ul of organic free reagent water into an evacuated 6-Liter canister fitted with an injection septa and nut. Open valve and the vacuum will draw in the water. This process will secure any active sites.

10.3.2 Fill the canister to just above ambient pressure (psig) and remove on/off valve. The canister is simulating a dilution flask.

10.3.3 Inject 10ul of the 210ug/ml intermediate naphthalene standard (10.2) with a 10ul syringe into the canister and re-attach the on/off valve.

10.3.4 Attach zero grade air and pressurize to 9.8psig, which is equivalent to 10 Liters volume.

10.3.5 Allow standard to equilibrate for approximately 24 hours prior to use.

10.4 40ppbv naphthalene gas standard – Option B

10.4.1 Attach the zero gas line to an evacuated canister with an in-line "T" connector. The "T" connector is to be fitted with septa and nut on the open port to allow for water and methanolic standard introduction.

10.4.2 Adjust air pressure to exactly 9.8 psig and open valve. Rapidly inject 80ul of organic free water through the sepa port to secure active sites and close valve.

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- 10.4.3 Measure 10ul of the 210ug/ml intermediate naphthalene standard (10.2). Make sure the air is turned on to the 9.8 psig and open canister valve. Rapidly inject the methanolic standard through the septa port.
- 10.4.4 Allow canister to reach the 9.8 psig final pressure and shut the valve.
- 10.4.5 Allow standard to equilibrate for approximately 24 hours prior to use.
- 10.5 Calculation: The amount of standard to be used is determined as follows:
- 10.5.1 Pressurizing the canister to 24.5psia or 9.8psig is equivalent to 10-Liters volume.
- 6 Liters x 24.5psia/14.7psia = 10 Liters
- Inject 10ul of a 210ug/ml standard = 2.1ug in 10 Liters
- 2.1ug/10L = 210ug/m<sup>3</sup>
- ug/m<sup>3</sup> x 24.45/mw = ppbv, naphthalene MW = 128
- 210ug/m<sup>3</sup> = 24.45/128 = 40ppbv

### 11.0 DYNAMIC DILUTION STANDARD PREPARATION

- 11.1 5ppb and 40ppbv Calibration Standards
- 11.1.1 Allow Entech 4560SL to warm up for 30 minutes.
- 11.1.2 A zero air line at 45 psig is plumbed through a canister equipped with dip tube containing 300ml of deionized water to humidify the dilution gas. Attach this utilizing a 1/4" flushed copper tube to Mass Flow Controller (MFC) port 1.
- 11.1.3 A 1ppmv TO-15 calibration gas is attached to MFC port 2 and set at 45-psig head pressure to allow for the proper pressure differential.
- 11.2 From the software control, enter the calculated mass flow controller values, which is 995sccm for MFC1 or dilution gas and 5sccm for the standards attached to MFC2. This is a 1:200 dilution blend to result in a 5ppbv working calibration standard. (The mass flow controllers should be calibrated approximately every 3 months or when standards do not seem linear between the 5 and 40ppbv levels).
- 11.3 A dilution gas flow of 960sccm to 40sccm for the standards would make up a 40ppbv standard since this is a 1:25 dilution.
- 11.4 Open the isolation valve and let gasses purge for a few minutes.
- 11.5 Attach pressure sensor canister fill line to the canister port and tighten.

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11.6 Select "go" on the software control and open canister to begin filling. Notice the pressure sensor reading in psia on the software control drops dramatically to correspond with the high vacuum of the prepared canister. Final canister pressure is irrelevant.

### **11.7 0.2 ppbv Calibration Standard**

11.7.1 Utilizing a 500cc gas tight syringe, introduce 480cc of the 5ppbv standard in to an evacuated 6-liter canister through an injection port adapter.

11.7.2 Attach the helium fill line to the canister and pressurize to 14.7psig which is equivalent to 12-liters of volume.

### **11.8 0.5ppbv Calibration Standard**

11.8.1 Utilizing a 500cc gas tight syringe, introduce a total of 1200cc of the 5ppbv standard in to an evacuated 6-liter canister through an injection port adapter. This requires two volumes of 500cc and one volume of 200cc.

11.8.2 Attach the helium fill line to the canister and pressurize to 14.7psig which is equivalent to 12-liters of volume.

### **11.9 40ppbv Laboratory Control Standard (LCS)**

11.9.1 The 1ppmv Spectra Gases second source standard is prepared the same as the Spectra Gases cal standard and the final pressure does not have to be monitored. A LCS is used to verify calibration with a second or external source standard.

11.9.2 100cc of this standard is used for an equivalent 10ppbv LCS.

### **11.10 Method Blank**

11.10.1 A 6 liter evacuated canister is filled and pressurized to approximately 15 psig with zero grade air.

11.11 Working Standards Storage Period – Any working standards or LCS must not used after 30 days from preparation. An expiration date of 30 days after the preparation date must be documented on the standards tag and standards logbook.

## **12.0 SUMMA CANISTER SHIPPING AND RECEIVING**

### **12.1 Canister Shipping**

12.1.1 Record prepared certified summa canister (Refer to SOP) and vacuum in canister logbook. Vacuum must be recorded to the nearest 0.2" hg Vacuum.

12.1.2 For integrated sampling, a canister must be equipped with a clean calibrated detachable flow controller.

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- 12.1.3 The flow controller is calibrated by attaching it to a "practice" canister under vacuum and adjusting the flow control calibrator while measuring the flow in cc/min with a flow meter.
- 12.1.4 Some vacuum should remain in the canister after sampling for more stability. Therefore measure the flow over the specified sampling period to fill the canister with about 5 liters of air. This would leave a vacuum of about 5" Hg.
- 12.1.5 For a 24 hour sample this would be 5000cc/ (60min)(24 hr) or 3.5cc/min.
- 12.1.6 Grab samples are summa canisters without flow controllers taking about 20 seconds to fill.

### 12.2 Canister Receipt

- 12.2.1 Upon receipt of the canister, the pressure or vacuum should be checked to ensure proper sampling was performed. If excessive vacuum (>15" Hg) is measured the client should be notified to inquire about the shortened sampling period and re-sampling.
- 12.2.2 The pressure or vacuum along with received date and lab sample number must be recorded in the canister logbook to the nearest 0.2 "hg vacuum or 0.2 psig if under positive pressure.
- 12.2.3 Canisters received at greater than or equal to 8" Hg vacuum, must be pressurized to ensure sample draw with the diaphragm pump.
- 12.2.4 Refer to the "Canister Pressurization Calculation" in table 5.
- 12.2.5 If a flow controller was supplied, the flow should be verified upon receipt and recorded in the logbook.

### 12.3 Canister Shelf-life

- 12.3.1 Canisters are valid up to 2 months of batch certification.
- 12.3.2 Canister labels are to be labeled with an expiration date when certification is completed with a notation of "exp." followed by the 2- month expiration date.  
**Example: "exp. 5/02/02"**
- 12.3.3 Canisters must be monitored during storage to allow clients ample time to collect sample prior to shipping. If time period to expiration is a week or less, clients must be contacted to determine an accurate sampling date.

## 13.0 INSTRUMENT CONDITIONS

### 13.1 Entech Autosampler/ Concentrator conditions

- 13.1.1 7016CA autosampler Valve: 100°C

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## 13.1.2 Transfer Line: 80°C

## 13.1.3 7100 Concentrator

	<u>Internal</u>	<u>Standard</u>	<u>Sample</u>	<u>Sweep Gas</u>	<u>Transfer</u>
Preflush (sec)	5	2	15	5	-
Flow Rate (sccm)	100	150	150	100	15
Vol (cc/min)	100	varies	varies	75	40

Note: the mass flow controller may have a false reading in standby, as in 5 or 6. The trapping cc/min should be increased by this amount as per the manufacturer (100 should be set at 105 or 106 in this case).

	<u>Trap</u>	<u>Preheat</u>	<u>Desorb</u>	<u>Bake</u>
Module 1	-150 °C	20 °C	20 °C	150 °C/ 10 min
Module 2	-10 °C	no	180 °C	190 °C/ 3.5 min
Module 3	-150 °C	100 °C	4.5min	100 °C/ 3min

GC/MS Transfer line 100 °C

Total event cycle time 35 min

## 13.2 GC Conditions

13.2.1 Hewlett Packard 5980 or Agilent 6890 gas chromatograph.

13.2.2 Column – Restek 60 meter RTX-1, 0.25mm id, 1.0 um film thickness.

13.2.3 Helium carrier gas at approx. 12psig column head pressure.

13.2.4 GC Temperatures:

Injection port	120 °C
Detector	280 °C
Oven	40 °C held for 5min 8 °C /min to 210 °C and held for 0.0min 25 °C/min to 260 °C and held for 3.0min
Total runtime	29.25 min
Electronic Pressure Control:	Constant Flow at 1.4cc/min

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Purge Valve

Off at 1.00 min

## 13.3 Mass Spectrometer Conditions

- 13.3.1 Hewlett Packard 5971 or Agilent 5973 MSD.
- 13.3.2 Capable of scanning from 35-300 amu every 3.0 seconds or less utilizing a 70 volt (nominal) electron energy in the electron impact ionization mode.
- 13.3.3 Threshold set at 250 with a solvent delay of approximately 3.3 minutes or just before the starting elution of the first compound.
- 13.3.4 Capable of producing a mass spectrum which meets all the criteria in Table 1 when injecting 100cc of 20ppbv 4-Bromofluorobenzene (BFB). This is equivalent to 5ppbv when considering a 400cc nominal volume.

## 13.4 Data System

- 13.4.1 A computer system is interfaced to the mass spectrometer, which allows for continuous acquisition and storage on machine- readable media (disc) of all mass spectra obtained throughout the duration of the chromatographic program.
- 13.4.2 The computer utilizes software, which allows searching any GC/MS data file for target analytes which display specific fragmentation patterns.
- 13.4.3 The HEWLETT PACKARD ENVIROQUANT (PC) data system is capable of quantitation using multi-point calibration and multipoint internal standards.
- 13.4.4 The NIST mass spectral library (75,000 compounds) is being used for non- target peak tentative identification.

## 14.0 SAMPLE ANALYSIS

### 14.1 Daily BFB system performance tuning.

- 14.1.1 The 40ppbv internal standard and 20ppbv surrogate is attached to the internal standard port of the Entech 7100 utilizing flushed 1/8" copper tubing.
- 14.1.2 100cc of this standard will be sampled which is equivalent to 5ppbv of BFB.
- 14.1.3 The GC/MS and Entech concentrator conditions will be the same as in section 11 with the sample amount and standard amount set to "0".
- 14.1.4 Once the tune is complete, spectra of the background subtracted BFB peak must be checked to verify acceptable performance criteria are achieved (see Table 1).
- 14.1.5 This performance test must be passed before any samples, blanks, or standards are analyzed.

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- 14.1.6 If all the criteria are not achieved, the analyst must retune the mass spectrometer and repeat the test until all criteria are met.
- 14.1.7 The injection time of the acceptable tune analysis is considered the start of the 24-hour clock.

### 14.2 Initial Calibration

- 14.2.1 A 5 to 6 level calibration is performed utilizing 0.2, 0.5, 2, 5, 10, 20, 40 ppbv for all compounds. The 0.2ppbv and 0.5ppbv must be part of the calibration curve to satisfy the reporting limits.
- 14.2.2 The 0.2ppbv, 0.5ppbv, 5ppbv and 40ppbv calibration standards are attached to sample ports on the Entech 7100.
- 14.2.3 Considering a nominal volume of 400cc, a volume of 100cc will be sampled from the 0.5ppbv standard for an equivalent 0.05ppbv (1:4). The volumes of 400cc will be sampled from each of the 0.2ppbv and 0.5ppbv standards to be equivalent to those concentrations. The volumes of a 5ppbv standard to be sampled will be 160, and 400cc to be equivalent to 2.0, and 5.0ppbv respectively. Volumes of 100, 200 and 400 from the 40ppbv standard are equivalent to 10, 20, and 40ppbv. The 5ppbv standard can alternatively be taken from the 40ppbv standard at 50cc.
- 14.2.4 The internal standard/ surrogate volume will be 100cc for all standards, samples and quality control resulting in a 10ppbv internal standard and 5ppbv surrogate standard concentration.
- 14.2.5 The linear range covered by this calibration is highest concentration standard.
- 14.2.6 Detector Saturation - Occasionally, several compounds in higher concentration standards may exhibit chromatographic peak saturation. Unsymmetrical peaks that initially appear to be symmetrical that exhibit a perpendicular drop to the baseline are characteristic of peak saturation. The apex of a saturated peak may also look abnormal and may exhibit a plateau. Saturated chromatographic peaks must not be used in the calibration curve and must be eliminated from the calibration. This will result in decreased concentration for the upper calibration range limit.
- 14.2.7 The Response Factor (RF) is calculated for each compound at every standard level.

Response Factor (RF)

$$RF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

where:  $A_s$  = Area of the characteristic ion for the compound being measured.  
 $A_{is}$  = Area of the characteristic ion for the specific internal standard.  
 $C_s$  = Concentration of the compound being measured (ppbv).

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Cis = Concentration of the specific internal standard (ppbv).

- 14.2.8 Percent Relative Standard Deviation (% RSD) is calculated for all calibration levels used.

$$\%RSD = \frac{SD}{RFav} \times 100$$

where: SD = Standard Deviation  
RFav = Average response factor from initial calibration.

- 14.2.9 The following criteria must be met for the initial calibration to be valid.

- 14.2.9.1 The percent relative standard deviation must be less than 30 %.
- 14.2.9.2 Up to two compounds may exceed 30% but must be less than 40% for a valid initial calibration.
- 14.2.9.3 The relative retention time (RRT) for each target compound at each calibration level must be within 0.06 RRT units of the mean RRT for the compound.
- 14.2.9.4 The area response of each calibration level must be within 40% of the mean area response over the initial calibration range for each internal standard.
- 14.2.9.5 The retention time shift for each of the internal standards at each calibration level must be within 20 seconds (0.33 minutes) of the mean retention time over the initial calibration range for each internal standard.

- 14.2.10 10ppbv Naphthalene standard.

- 14.2.10.1 100cc of the 40ppbv standard (10.2, 10.3) is, collected by the autosampler and concentrator.
- 14.2.10.2 Due to the instability of heavier boiling point compounds as in naphthalene, a single point standard is run with any targets reported must have an "E" qualifier along with a footnote stating "Estimated value due to compound instability in air." Only Naphthalene is reported at this time.

- 14.2.11 Initial Calibration Verification (ICV).

- 14.2.11.1 The calibration must be verified by the analysis of a standard prepared from a source independent from the calibration standards. Refer to the continuing calibration section (14.3.2) for acceptance criteria. If the ICV does not meet acceptance criteria corrective action must be taken to correct the problem, and a new initial calibration must be analyzed along with a satisfactory ICV.

### 14.3 Continuing calibration

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14.3.1 A continuing calibration check standard is alternated at varying concentrations. Concentrations of 10ppbv and 20ppbv are used for the continuing calibration. Calibration checks must be acquired every 24 hrs which is equivalent to 100 cc and 200cc of the 40ppbv standard for 10ppbv and 20ppbv respectively.

14.3.2 The percent difference for all continuing calibration compounds must be  $\leq 30\%$ .

Percent Difference (%D).

$$\%D = \frac{(C_q - C_c)}{C_q} \times 100$$

Where:  $C_q$  = Calibration Check Compound standard concentration.

$C_c$  = Measured concentration using selected quantitation method.

- The %D for each target compound in continuing calibration must be within +/- 30%.
- Naphthalene would be an exception to this criterion since a standard is not commercially available due to its instability in air. A static dilution standard would have to be prepared and any "hits" in samples should be qualified as estimated with an "E".

14.3.3 If either of the criteria fail, a new initial calibration must be performed.

#### 14.4 Internal Standard

14.4.1 100 cc of the internal/ surrogate standard is equivalent to 10ppbv that is added to all standards, samples and QC.

14.4.2 If any of the internal standard areas change by a factor of +/-40% or retention time changes by more than 0.33 minutes from the last daily calibration check standard of the 10 ppbv level of the initial calibration, the mass spectrometer must be inspected for malfunctions and corrections will be made, as appropriate.

#### 14.5 Method Blank

14.5.1 A 6-liter evacuated canister is filled to above ambient pressure with zero grade air.

14.5.2 A volume of 400cc of the method blank is sampled to simulate an undiluted sample analysis.

14.5.3 Method blanks are analyzed prior to any samples and should be non-detect for all target compounds. Occasionally lab background such as isopropanol cannot be fully eliminated and should be flagged appropriately in any samples.

#### 14.6 Sample analysis – General

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- 14.6.1 Typically a 400 cc sample volume at near ambient pressure is standard for analysis to achieve the reporting limits required. Smaller sample amounts down to 40 cc can be sampled accurately with the concentrators mass flow controller.
- 14.6.2 This volume may be adjusted for sample canister pressurization when samples are received greater or equal to 8"Hg vacuum. Refer to table 5.  
Example: If a sample is received at 9"Hg vacuum and pressurized to 1.2psig, 590cc of the sample should be drawn to compensate and remain a quant. factor of 1.
- 14.6.3 Further dilution's can be performed by diluting samples in additional canisters or minicans.
- 14.6.4 Unknown samples should be screened by PID/FID to reduce the risk of system overload. Screening may be performed using a Tedlar bag (is attached to the sampling port using a steel nut with Teflon ferrule).

## 14.7 Summa canister sample analysis

- 14.7.1 Canister pressure should be checked and recorded upon receipt by the laboratory as in section 12.2.1.
- 14.7.2 The canister may be pressurized upon receipt if excessive vacuum remains at receipt ( $\geq 8$  " Hg). If the canister is pressurized, the sampling volume must be adjusted to compensate for the dilution. Refer to the "Canister Pressurization Calculation" in table 5.

## 14.8 Sample Dilution

- 14.8.1 Less sample volume can be designated by the concentrator software down to 40cc. With normal volume being 400cc, this would result in a 1:10 dilution. Further dilutions will require a dilution into a secondary vessel.
- 14.8.2 In order to manually draw a volume out of a canister, positive canister pressure is required.
- 14.8.3 Refer to Table 5 for the proper pressurization.
- 14.8.4 A measured volume of the newly pressurized original canister is drawn out with a gas-tight syringe and introduced into a secondary vessel (6-Liter canister or 375cc minican). The secondary vessel is the pressurized with zero grade air.
- 14.8.5 The final sample multiplier is (original canister dilution factor) x (secondary vessel dilution factor) x (instrument dilution factor). The instrument dilution factor is the nominal volume of 400cc/ amount of sample introduced by autosample.

Example,

Original canister is pressurized to a factor of 1.2

The amount introduced to the dilution vessel results in an additional factor of 10

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The autosampler introduces 40cc from the secondary vessel for an additional factor of  $400/40 = 10$

Final sample multiplier =  $1.2 \times 10 \times 10 = 120$

14.8.6 The diluted sample result should be within the upper portion of the calibration curve.

### 15.0 DATA REVIEW & INTERPRETATION

15.1 Qualitative identification. Analyst shall identify the targeted compounds with competent knowledge in the interpretation of mass spectra by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound. The criteria required for a positive identification are:

- 15.1.1 The sample component must elute at the same relative retention time (RRT) as the daily standard. Criteria are the RRT of sample component must be within  $\pm 0.06$  RRT units of the standard.
- 15.1.2 All ions present in the standard mass spectra at a relative intensity greater than 10 % (major abundant ion in the spectrum equals 100 %) should be present in the sample spectrum.
- 15.1.3 The relative intensities of these ions must agree within  $\pm 30$  % between the daily standard and sample spectra. (Example: For an ion with an abundance of 50 % in the standard spectra, the corresponding sample abundance must be between 20 and 80 %).
- 15.1.4 Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25 % of sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

### 15.2 Quantitative analysis

- 15.2.1 When a target compound has been identified, concentration (see section 15.1) will be based on the integrated area of the quantitation ion, normally the base peak (see Table 4).
- 15.2.2 If the sample produces interference for the primary ion, use a secondary ion to quantitate (see Table 4). This is characterized by an excessive background signal of the same ion, which distorts the peak shape beyond a definitive integration. Also interference could severely inhibit the response of the internal standard ion. This secondary ion must also be used to generate new calibration response factors.

### 15.3 Library search for tentatively identified compounds.

If a library search is requested, the analyst should perform a forward library search of NIST mass spectral library to tentatively identify 15 non-reported compounds. Guidelines for making tentative identification are listed below.

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- 15.3.1 These compounds should have a response greater than 10 % of the nearest internal standard. The response is obtained from the integration for peak area of the Total Ion Chromatogram (TIC).
- 15.3.2 The search is to include a spectral printout of the 3 best library matches for a particular substance. The results are to be interpreted by analyst.
- 15.3.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.
- 15.3.4 Relative intensities of major ions in the reference spectrum (ions > 10 % of the most abundant ion) should be present in the sample spectrum.
- 15.3.5 The relative intensities the major ions should agree within  $\pm 20$  %.
- 15.3.6 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.
- 15.3.7 Ions present in the reference spectrum but not in the sample spectrum should be verified by performing further manual background subtraction to eliminate the interference created by coeluting peaks and/or matrix interference.
- 15.3.8 Quantitation of the tentatively identified compounds is obtained from the total ion chromatogram based on a response factor of 1 and is to be tabulated on the library search summary data sheet.
- 15.3.9 Quantitation will be performed on the nearest internal standard.

**16.0 QUALITY CONTROL**

QC Requirements Summary:

BFB.	Every 24 hrs.
Calibration Check std.	Every 24 hrs.
Batch blank	Every 24 hrs.
Matrix Duplicate	one per 20 samples
Lab Control Sample (LCS)	one per 20 samples
Surrogate	every sample and standard.
Internal Standard	every sample and standard.

- 16.1 Daily GC/MS Performance Check - refer to section 14.1.
- 16.2 Daily Calibration Check - refer to section 14.3.
- 16.3 Method Blank (zero grade air) at 400 cc - refer to section 14.5.
- 16.4 Matrix Duplicate.

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- 16.4.1 One sample is selected at random. The Relative Percent Difference (RPD) (section 17.3) should be calculated for all hits. The RPD is compared to in-house generated limits (once available). An RPD of 25 will be used to evaluate the duplicate until sufficient in-house data is available – and as a low default. If the duplicate does not meet acceptance criteria it should be reanalyzed.

### 16.5 Laboratory Control Sample (LCS)

- 16.5.1 Laboratory Control Standard (LCS) is prepared to contain 20ppbv each analyte from a source other than the calibration standard. 200 cc of the LCS is sampled in duplicate (LCSD) for a 10ppbv.
- 16.5.2 Percent recoveries (% R) (see section 17.2) are compared to in-house generated limits. All of the compounds must be within acceptable ranges with one exception. The LCS will be considered acceptable if biased high (recovery) as long as no hits are reported in associated samples. A low recovery bias will necessitate reanalysis (see 16.5.3).
- 16.5.3 If laboratory control samples do not meet criteria, calculations should be checked. A new LCS should be prepared and analyzed and possibly a new calibration if the problem isn't rectified.

### 16.6 Surrogate

- 16.6.1 All blanks, samples, and matrix spikes contain surrogate compounds that are used to monitor method performance. All samples are spiked with 100cc of the internal/surrogate standard that is equivalent to 5ppbv of 4-Bromofluorobenzene.
- 16.6.2 If the % recovery (see section 17.2) of 4-Bromofluorobenzene does not meet in-house control limits the recovery must be flagged and:
- 16.6.2.1 The calculation must be checked.
- 16.6.2.2 The sample must be reanalyzed to verify recovery of the surrogate is out of control limits due to apparent matrix interference.
- 16.6.3 If surrogate recoveries are acceptable upon reanalysis, the data from the reanalysis is reported. If the surrogate recoveries are still not within acceptance criteria the reported sample results must be footnoted accordingly.
- 16.6.4 Note: As database records become available, method accuracy will be assessed by calculating average percent recovery (AVE %R) and the standard deviation (SD) of recovery to express control limits as AVE %R +/- 3SD.

### 16.7 Internal Standard.

- 16.7.1 Retention time for all internal standard must be within  $\pm .33$  minutes of the corresponding internal standard in the latest continuing calibration or 10ppbv standard of initial calibration.

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- 16.7.2 The area (Extracted Ion Current Profile) of the internal standard in all analyses must be within +/-40 % of the corresponding area in the latest calibration standard (24 hr. time period).
- 16.7.3 If area of internal standard does not meet control limits, the calculations must be checked. If a problem is not discovered, the sample must be reanalyzed.
- 16.7.4 If areas are acceptable upon reanalysis, the reanalysis data is reported.
- 16.7.5 If areas are unacceptable upon reanalysis, then both sets of data are submitted with the original analysis reported. If matrix interferences are visibly present in the chromatogram, a smaller volume may be analyzed.
- 16.8 A Precision and accuracy (P&A) study is performed as an initial determination of capability, on an annual basis (continued demonstration of capability – a successful PT result may be used in place of a P&A for continued DOC), and if any significant changes have been made to the instrument. In general, 4 replicates or LCS's are analyzed using the same procedures and conditions for sample analysis. The percent recovery and standard deviation (of the 4 replicate percent recoveries) are compared to in-house control limits. If percent recovery or standard deviation criteria are not met, corrective action must be taken to bring the system back into control.
- 16.9 Data assessment and acceptance criteria for quality control. Quality control limits are generated at least on an annual basis by QA using an in-house program. Blank spike, MS/MSD, and surrogate QC data are pooled for the previous year (or other specified time frame) and the data is processed and evaluated by QA. The new limits are entered into the LIMS where they can be viewed directly or by printing out a compound list (QC limits must be requested). The annual QC limit data is filed with QA.

## 17.0 CALCULATIONS

### 17.1 Concentration (Conc.)

$$\text{Conc. (ug/l)} = \frac{A_c \times C_{is} \times V_p \times DF_c}{A_{is} \times RF \times V_i}$$

Where:  $A_c$  = Area of characteristic ion for compound being measured.  
 $A_{is}$  = Area of the characteristic ion for the specific internal standard.  
 $C_{is}$  = Concentration of the specific internal standard (ug/l).  
 $V_p$  = 400cc ( Standard Volume )  
 $DF_c$  = Canister dilution factor from pressurization

$RF$  = average response factor from initial calibration

$V_i$  = volume of sample (cc).

### 17.2 Percent Recovery (% R)

$$\% R = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

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**17.3 Relative Percent Difference (RPD)**

$$RPD = \frac{|SC - SDC|}{(1/2)(SC + SDC)} \times 100$$

Where: SC = Sample Concentration  
SDC = Sample Duplicate Concentration

**18.0 DOCUMENTATION**

- 18.1 The analytical logbook is a record of the analysis sequence; the logbook must be completed daily. Each instrument will have a separate logbook.
- 18.2 If samples require reanalysis, a brief explanation of the reason should be documented in this log.
- 18.3 The standard preparation logbook must be completed for all standard preparations. All information requested must be completed; the page must be signed and dated by the respective person.
- 18.4 The Accutest lot number must be cross-referenced on the standard vial/container. The expiration date must be noted on the standard vial/container.
- 18.5 The instrument Maintenance logbook must be completed when any type of maintenance is performed on the instrument. Each instrument will have a separate log.
- 18.6 All laboratory logbooks must be routinely reviewed and initialed or signed by the lab manager.
- 18.7 Any corrections to laboratory data must be done using a single line through the error. The initials of the person and date of correction must appear next to the correction.

**19.0 DATA REVIEW**

- 19.1 The analyst conducts the primary review of all data. This review begins with a check of all Instrument and method quality control and progresses through sample quality control concluding with a check to assure that the client's requirements have been executed. The analyst has the authority and responsibility to perform corrective action for any out-of-control parameter of non-conformance.
- 19.2 A secondary review is performed by department managers, and it includes review of the data produced by their department. All manual calculations, QC criteria, and a comparison of the data package to client specified requirements are checked. The department manager may reject data, initiate reanalysis, take additional corrective action, or reprocess data.
- 19.3 The laboratory director performs a full tertiary review of the data package following its assembly. This review includes an evaluation of QC data against acceptance criteria and a check of the data package contents to assure that all analytical requirements and specifications were executed.

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- 19.4 Spot-check reviews are performed by the Quality Assurance Officer focusing on all elements of the deliverable including the client's specifications and requirements, analytical quality control, sample custody documentation and sample identification.

## **20.0 DATA REPORTING**

- 20.1 A results page including positive results and/or RLs, units, methodology, preparation and/or analysis dates, and data qualifiers are reported. Additional quality control data including calibration summaries, MS/duplicate percent recoveries and RPDs, surrogate recoveries, blank spike recoveries, and method blank results may be reported upon request of the client. Additionally, raw data including any instrument printouts (quantitation reports, chromatograms), laboratory logbooks, etc. may be reported to the client.
- 20.2 Data may be submitted to the client in a specified electronic format (EDD).
- 20.3 Data may be submitted to the client as a PDF (e-hardcopy).
- 20.4 Once the data is approved by the laboratory manager, it may be accessed by clients via LabLink™.
- 20.5 All data qualifiers used within the result page (sample or QC results) are defined at the bottom of the page. Refer to the Accutest Laboratories of New England, Inc. Qualifier Definitions form (QA108) for definition of all qualifiers used in Accutest Laboratories of New England result reports. This form is located on the QA server under QA forms. It may be provided to the client upon request.
- 20.6 Procedures for handling out-of-control or unacceptable data.
- 20.6.1 If quality control data does not meet criteria the non-conformance must be discussed in a case narrative and footnoted on the applicable quality control report summary.
- 20.6.2 If preservation or holding time criteria is not met and the samples are analyzed the result page must be footnoted with this information, and the non-conformance must be discussed in a case narrative or other suitable communication (telephone conversation log or email). Client notification documentation should be included with the data (telephone conversation log, fax, or email).

## **21.0 APPARATUS CLEANING**

- 21.1 Sample syringes and canister syringe adapters are cleaned between use by baking at 50 C for 20 minutes. Higher temperatures can crack the barrel of the fixed needle syringe. The syringes and adapters are also flushed with the actual sample prior to final aliquot injection.
- 21.2 Summa canisters are cleaned and certified (refer to SOP MMS304.)

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**22.0 POLLUTION PREVENTION & WASTE MANAGEMENT**

- 22.1 Pollution Prevention. Users of this method must perform all procedural steps that controls the creation and/or escape of wastes of hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids, or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 22.2.
- 22.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the Sample and Waste Disposal SOP. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:
- 22.2.1 Non-hazardous aqueous wastes
  - 22.2.2 Hazardous aqueous wastes
  - 22.2.3 Chlorinated organic solvents
  - 22.2.4 Non-chlorinated organic solvents
  - 22.2.5 Hazardous solid wastes
  - 22.2.6 Non-hazardous solid wastes
  - 22.2.7 Microbiological wastes

**23.0 ADDITIONAL REFERENCES**

- 23.1 None.

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**Table 1**

**BFB KEY IONS AND ION ABUNDANCE CRITERIA**

Mass	Ion Abundance Criteria
50	8-40% of mass 95
75	30-66% of mass 95
95	Base peak, 100% relative abundance
96	5-9% of mass 95
173	< 2% of mass 174
174	50% - 120% of mass 95
175	4 - 9% of mass 174
176	93% - 101% of mass 174
177	5 - 9% of mass 176

**Table 2**

**INTERNAL STANDARD IONS**

Internal Standard	Prim/Sec. Ions
Bromochloromethane	128 / 49, 130, 51
1,4-Difluorobenzene	114 / 63,88
Chlorobenzene-d5	117 / 82, 119

**Table 3**

**SURROGATE CONTROL LIMITS**

Compound	(Prim/Sec. ions)	% Recovery
4-Bromofluorobenzene	(95 / 174, 176)	In-House

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Table 4

**TARGET COMPOUND IONS**

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)
Acetone	58	43
Benzene	78	77, 52
Benzyl chloride	91	126, 65
1,3-Butadiene	39	54, 53
Bromodichloromethane	83	85, 122
Bromoform	173	175, 254
Bromoethene	106	108, 81
Bromomethane	94	96, 95
Carbon disulfide	76	78, 44
Carbon tetrachloride	117	119, 121
Chlorobenzene	112	77, 114
Cyclohexane	84	56, 69
Chloroethane	64	66, 49
Chloroform	83	85, 47
Chloromethane	50	52, 32
3-Chloropropene	76	41, 39, 78
2-Chlorotoluene	91	126, 63
Dibromochloromethane	129	127, 31
1,2-Dibromoethane	107	109, 88
1,2-Dichlorobenzene	146	111, 148
1,3-Dichlorobenzene	146	111, 148
1,4-Dichlorobenzene	146	111, 148
Dichlorodifluoromethane	85	87, 50
1,1-Dichloroethane	63	65, 83
1,2-Dichloroethane	62	64, 98
1,1-Dichloroethene	96	61, 63
cis-1,2-Dichloroethene	96	61, 98
trans-1,2-Dichloroethene	96	61, 98
1,2-Dichloropropane	63	65
1,4-Dioxane	88	57, 58, 43
cis-1,3-Dichloropropene	75	77, 39
trans-1,3-Dichloropropene	75	77, 39
Ethanol	45	46, 42
Ethyl Acetate	43	61, 88
4-Ethyltoluene	105	120, 91
Ethylbenzene	91	106, 77
Freon 113	151	101, 103
Freon 114	85	135, 87
Hexachlorobutadiene	225	223, 227
Heptane	43	71, 57
Hexane	57	47, 41

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Table 4 -continued

**TARGET COMPOUND IONS**

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)
2-Hexanone	43	58, 100
Isopropyl Alcohol	45	43, 59
Methyl-t-butyl ether	73	57, 43
Methylene chloride	84	86, 49
Methyl ethyl ketone	72	43, 57
Propylene	41	39, 42
Styrene	104	78, 103
Tetrahydrofuran	42	71, 72
1,2,4-Trichlorobenzene	180	182, 145
1,1,2,2-Tetrachloroethane	83	85, 131
Tetrachloroethene	164	129, 131, 166
Toluene	92	91, 65
1,1,1-Trichloroethane	97	99, 61
1,1,2-Trichloroethane	83	97, 85
Trichloroethene	95	97, 130, 132
Trichlorofluoromethane	101	103, 105
1,2,4-Trimethylbenzene	105	120, 119
1,3,5-Trimethylbenzene	105	120, 119
2,2,4-Trimethylpentane	57	56, 99
Vinyl acetate	43	86, 44
Vinyl chloride	62	64, 61
o-Xylene	106	91, 77
m-Xylene	106	91, 77
p-Xylene	106	91, 77
Pentane	42	41, 57
Nonane	43	71, 128
Isopropylbenzene(Cumene)	105	120, 77
Tertiary Butyl Alcohol	59	41, 43
Naphthalene	128	127, 129

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Table 5

Canister Pressurization Calculations												
Canister Pressure Received					Canister Final Pressure					Dilution	Sampling	
"Hg (vac)	"Hg	atm	psia	Vol. (L)	"Hg	psia	Vol. (L)	psig		Factor	Volume (cc)	
0.0	29.92	1.00	14.7	6.0	29.92	14.7	6.0	0.0		1	400	
0.5	29.42	0.98	14.5	5.9	29.42	14.5	5.9	-0.2		1	400	
1.0	28.92	0.97	14.2	5.8	28.92	14.2	5.8	-0.5		1	400	
1.5	28.42	0.95	14.0	5.7	28.42	14.0	5.7	-0.7		1	400	
2.0	27.92	0.93	13.7	5.6	27.92	13.7	5.6	-1.0		1	400	
2.5	27.42	0.92	13.5	5.5	27.42	13.5	5.5	-1.2		1	400	
3.0	26.92	0.90	13.2	5.4	26.92	13.2	5.4	-1.5		1	400	
3.5	26.42	0.88	13.0	5.3	26.42	13.0	5.3	-1.7		1	400	
4.0	25.92	0.87	12.7	5.2	25.92	12.7	5.2	-2.0		1	400	
4.5	25.42	0.85	12.5	5.1	25.42	12.5	5.1	-2.2		1	400	
5.0	24.92	0.83	12.2	5.0	24.92	12.2	5.0	-2.5		1	400	
5.5	24.42	0.82	12.0	4.9	24.42	12.0	4.9	-2.7		1	400	
6.0	23.92	0.80	11.7	4.8	23.92	11.7	4.8	-3.0		1	400	
6.5	23.42	0.78	11.5	4.7	23.42	11.5	4.7	-3.2		1	400	
7.0	22.92	0.77	11.3	4.6	22.92	11.3	4.6	-3.4		1	400	
7.5	22.42	0.75	11.0	4.5	22.42	11.0	4.5	-3.7		1	400	"Hg(vac)
8.0	21.92	0.73	10.8	4.4	32.33	15.9	6.5	1.2		1.48	590	8.0
8.5	21.42	0.72	10.5	4.3	32.67	16.0	6.5	1.3		1.53	610	8.5
9.0	20.92	0.70	10.3	4.2	32.43	15.9	6.5	1.2		1.55	620	9.0
9.5	20.42	0.68	10.0	4.1	32.16	15.8	6.4	1.1		1.58	630	9.5
10.0	19.92	0.67	9.8	4.0	31.87	15.7	6.4	1.0		1.60	640	10.0
10.5	19.42	0.65	9.5	3.9	32.04	15.7	6.4	1.0		1.65	660	10.5
11.0	18.92	0.63	9.3	3.8	32.16	15.8	6.4	1.1		1.70	680	11.0
11.5	18.42	0.62	9.0	3.7	32.24	15.8	6.5	1.1		1.75	700	11.5
12.0	17.92	0.60	8.8	3.6	32.26	15.8	6.5	1.1		1.80	720	12.0
12.5	17.42	0.58	8.6	3.5	32.23	15.8	6.5	1.1		1.85	740	12.5
13.0	16.92	0.57	8.3	3.4	32.15	15.8	6.4	1.1		1.90	760	13.0
13.5	16.42	0.55	8.1	3.3	32.02	15.7	6.4	1.0		1.95	780	13.5
14.0	15.92	0.53	7.8	3.2	32.64	16.0	6.5	1.3		2.05	820	14.0
14.5	15.42	0.52	7.6	3.1	32.38	15.9	6.5	1.2		2.10	840	14.5
15.0	14.92	0.50	7.3	3.0	32.08	15.8	6.4	1.1		2.15	860	15.0

**Note:** Dilution factors are typically compensated for by concentrating more sample volume.

Calculations:  $\text{psia}(\text{rec}) \times \text{DF} = \text{psia}(\text{final})$

$\text{psia}(\text{final}) - 14.7 = \text{psig}(\text{final})$

## Conversion Equivalents

$0\text{"Hg}(\text{vac}) = 29.9\text{"Hg} = 1\text{atm} = 14.7\text{psia} = 0\text{psig}$

This will result in a quantitation factor of 1.

$\text{DF} \times \text{Volume}(\text{rec}) = \text{Volume}(\text{final}) \text{ in cc}$

$\text{DF} \times 400 = \text{Volume}(\text{cc}) \text{ introduced into concentrator for a quant factor of 1}$

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Table 6

Secondary Dilution Conversion Chart For 6-Liter Canisters

Initial				Final					Initial				Final			
"Hg (vac)	"Hg	psia	Vol. (L)	psia	psig	Vol. (L)	DF		"Hg (vac)	"Hg	psia	Vol. (L)	psia	psig	Vol. (L)	DF
0.0	29.9	14.7	6.0	15.4	0.7	6.30	1.05		7.6	22.3	10.6	4.5	15.9	1.2	6.49	1.45
0.2	29.7	14.6	6.0	15.3	0.6	6.26	1.05		7.8	22.1	10.9	4.4	15.8	1.1	6.43	1.45
0.4	29.5	14.5	5.9	15.2	0.5	6.21	1.05		8.0	21.9	10.8	4.3	15.6	0.9	6.37	1.45
0.6	29.3	14.4	5.9	15.8	1.1	6.47	1.10		8.2	21.7	10.7	4.4	15.5	0.8	6.31	1.45
0.8	29.1	14.3	5.8	15.7	1.0	6.42	1.10		8.4	21.5	10.6	4.3	15.4	0.7	6.25	1.50
1.0	28.9	14.2	5.8	15.6	0.9	6.38	1.10		8.6	21.3	10.5	4.3	15.7	1.0	6.41	1.50
1.2	28.7	14.1	5.8	15.5	0.8	6.33	1.10		8.8	21.1	10.4	4.2	15.6	0.9	6.35	1.50
1.4	28.5	14.0	5.7	15.4	0.7	6.29	1.10		9.0	20.9	10.3	4.2	15.9	1.2	6.50	1.55
1.6	28.3	13.9	5.7	15.3	0.6	6.25	1.10		9.2	20.7	10.2	4.1	15.8	1.1	6.44	1.55
1.8	28.1	13.8	5.6	15.9	1.2	6.48	1.15		9.4	20.5	10.1	4.1	15.6	0.9	6.38	1.55
2.0	27.9	13.7	5.6	15.8	1.1	6.44	1.15		9.6	20.3	10.0	4.0	15.5	0.8	6.32	1.55
2.2	27.7	13.6	5.6	15.7	1.0	6.39	1.15		9.8	20.1	9.9	4.0	15.8	1.1	6.45	1.60
2.4	27.5	13.5	5.5	15.5	0.8	6.35	1.15		10.0	19.9	9.8	4.0	15.7	1.0	6.39	1.60
2.6	27.3	13.4	5.5	15.4	0.7	6.30	1.15		10.2	19.7	9.7	4.0	15.5	0.8	6.33	1.60
2.8	27.1	13.3	5.4	15.3	0.6	6.25	1.15		10.4	19.5	9.6	3.9	15.3	0.7	6.27	1.65
3.0	26.9	13.2	5.4	15.9	1.2	6.48	1.20		10.6	19.3	9.5	3.9	15.7	1.0	6.39	1.65
3.2	26.7	13.1	5.3	15.7	1.0	6.44	1.20		10.8	19.1	9.4	3.8	15.5	0.8	6.33	1.65
3.4	26.5	13.0	5.3	15.6	0.9	6.38	1.20		11.0	18.9	9.3	3.8	15.8	1.1	6.45	1.70
3.6	26.3	12.9	5.3	15.5	0.8	6.33	1.20		11.2	18.7	9.2	3.8	15.6	0.9	6.38	1.70
3.8	26.1	12.8	5.2	15.4	0.7	6.28	1.20		11.4	18.5	9.1	3.7	15.9	1.2	6.50	1.75
4.0	25.9	12.7	5.2	15.3	0.6	6.25	1.25		11.6	18.3	9.0	3.7	15.7	1.0	6.43	1.75
4.2	25.7	12.6	5.2	15.8	1.1	6.45	1.25		11.8	18.1	8.9	3.6	15.6	0.9	6.36	1.75
4.4	25.5	12.5	5.1	15.7	1.0	6.40	1.25		12.0	17.9	8.8	3.6	15.3	0.7	6.30	1.80
4.6	25.3	12.4	5.1	15.5	0.8	6.35	1.25		12.2	17.7	8.7	3.6	15.7	1.0	6.39	1.80
4.8	25.1	12.3	5.0	15.4	0.7	6.30	1.25		12.4	17.5	8.6	3.6	15.9	1.2	6.50	1.85
5.0	24.9	12.2	5.0	15.9	1.2	6.50	1.30		12.6	17.3	8.5	3.5	15.7	1.0	6.42	1.85
5.2	24.7	12.1	5.0	15.8	1.1	6.42	1.30		12.8	17.1	8.4	3.4	15.6	0.9	6.35	1.85
5.4	24.5	12.0	4.9	15.7	1.0	6.39	1.30		13.0	16.9	8.3	3.4	15.8	1.1	6.45	1.90
5.6	24.3	11.9	4.9	15.5	0.8	6.34	1.30		13.2	16.7	8.2	3.4	15.6	0.9	6.38	1.90
5.8	24.1	11.8	4.8	15.4	0.7	6.29	1.30		13.4	16.5	8.1	3.3	15.8	1.1	6.46	1.95
6.0	23.9	11.7	4.8	15.3	0.6	6.27	1.35		13.6	16.3	8.0	3.3	15.6	0.9	6.38	1.95
6.2	23.7	11.7	4.8	15.7	1.0	6.42	1.35		13.8	16.1	7.9	3.2	15.8	1.1	6.46	2.00
6.4	23.5	11.6	4.7	15.6	0.9	6.37	1.35		14.0	15.9	7.8	3.2	15.6	0.9	6.38	2.00
6.6	23.3	11.5	4.7	15.5	0.8	6.31	1.35		14.2	15.7	7.7	3.2	15.4	0.7	6.30	2.00
6.8	23.1	11.4	4.6	15.3	0.6	6.27	1.40		14.4	15.5	7.6	3.1	15.2	0.6	6.22	2.00
7.0	22.9	11.3	4.6	15.8	1.1	6.43	1.40		14.6	15.3	7.5	3.1	15.1	0.4	6.14	2.00
7.2	22.7	11.2	4.6	15.7	1.0	6.38	1.40		14.8	15.1	7.4	3.0	14.9	0.2	6.06	2.00
7.4	22.5	11.1	4.5	15.5	0.8	6.32	1.40		15.0	14.9	7.3	3.0	14.7	0.0	5.98	2.00

**Calculations:**    psia(rec) x DF = psia(final)  
                          psia(final) - 14.7 = psig(final)

**Conversion Equivalents**

0"Hg(vac) = 29.9"Hg = 1atm = 14.7psia = 0psig





## Appendix D

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### Accutest Laboratories Annual Method Detection Limit Determination, February 2006 (*draft*)



Accutest Laboratories Annual Method Detection Limit Determination  
Marlboro, Ma Facility

Method: TO-15 (VTO14/15)  
Instrument(s): GCMSJ, GCMSQ  
Analyst: Pooled

Matrix: AIR  
Quant Factor: 1.00  
Study Period: February, 2006

Cmpd./Element/Param. Name	Analysis Date	Spike ppbv	Replicate Spikes							X-Bar ppbv	X-Bar %Recov.	STD.Dev. ppbv	MDL	Spike/MDL Ratio
			R1 ppbv	R2 ppbv	R3 ppbv	R4 ppbv	R5 ppbv	R6 ppbv	R7 ppbv					
Acetone	9-Feb-06	0.125	0.23	0.23	0.22	0.20	0.23	0.25	0.26	0.23	185.49	0.02	0.06	2.16
1,3-Butadiene	9-Feb-06	0.125	0.15	0.14	0.13	0.10	0.11	0.16	0.12	0.13	103.59	0.02	0.07	1.85
Benzene	9-Feb-06	0.125	0.14	0.14	0.12	0.11	0.12	0.13	0.13	0.12	99.15	0.01	0.04	3.43
Bromodichloromethane	9-Feb-06	0.125	0.13	0.13	0.11	0.11	0.12	0.14	0.14	0.13	101.73	0.01	0.04	3.30
Bromoform	9-Feb-06	0.125	0.18	0.11	0.10	0.08	0.10	0.12	0.10	0.11	88.52	0.03	0.10	1.29
Bromomethane	9-Feb-06	0.125	0.13	0.12	0.12	0.10	0.12	0.12	0.11	0.12	93.24	0.01	0.03	4.22
Bromoethene	7-Feb-06	0.25	0.23	0.22	0.24	0.21	0.23	0.23	0.23	0.23	90.65	0.01	0.03	7.16
Benzyl Chloride	7-Feb-06	0.25	0.13	0.11	0.12	0.12	0.11	0.13	0.11	0.12	47.37	0.01	0.03	8.52
Carbon disulfide	9-Feb-06	0.125	0.16	0.14	0.14	0.13	0.14	0.15	0.15	0.14	114.29	0.01	0.03	4.36
Chlorobenzene	9-Feb-06	0.125	0.15	0.12	0.11	0.10	0.11	0.12	0.12	0.12	94.75	0.02	0.05	2.45
Chloroethane	7-Feb-06	0.25	0.23	0.23	0.27	0.20	0.25	0.23	0.23	0.24	94.28	0.02	0.07	3.82
Chloroform	7-Feb-06	0.25	0.22	0.23	0.25	0.24	0.24	0.25	0.25	0.24	96.04	0.01	0.04	6.77
Chloromethane	9-Feb-06	0.125	0.17	0.15	0.14	0.12	0.14	0.14	0.13	0.14	113.54	0.01	0.04	2.92
3-Chloropropene	9-Feb-06	0.125	0.14	0.14	0.11	0.10	0.14	0.13	0.13	0.13	102.18	0.01	0.05	2.72
2-Chlorotoluene	7-Feb-06	0.25	0.22	0.22	0.23	0.22	0.22	0.21	0.22	0.22	87.14	0.01	0.03	9.55
Carbon tetrachloride	7-Feb-06	0.25	0.22	0.22	0.25	0.22	0.24	0.24	0.25	0.24	94.20	0.01	0.04	6.81
Cyclohexane	7-Feb-06	0.25	0.25	0.21	0.24	0.23	0.24	0.23	0.26	0.24	94.49	0.01	0.04	5.95
1,1-Dichloroethane	9-Feb-06	0.125	0.15	0.14	0.12	0.11	0.13	0.13	0.15	0.13	104.81	0.01	0.04	2.84
1,1-Dichloroethylene	9-Feb-06	0.125	0.12	0.12	0.11	0.09	0.11	0.11	0.12	0.11	88.41	0.01	0.03	3.91
1,2-Dibromoethane	9-Feb-06	0.125	0.14	0.12	0.10	0.10	0.10	0.11	0.11	0.11	89.98	0.02	0.05	2.65
1,2-Dichloroethane	9-Feb-06	0.125	0.14	0.14	0.12	0.11	0.13	0.15	0.14	0.13	107.13	0.01	0.04	3.08
1,2-Dichloropropane	9-Feb-06	0.125	0.14	0.11	0.12	0.10	0.13	0.14	0.14	0.13	101.76	0.02	0.05	2.53
1,4-Dioxane	9-Feb-06	0.125	0.06	0.03	0.03	0.02	0.02	0.03	0.02	0.03	25.05	0.01	0.04	2.87
Dichlorodifluoromethane	9-Feb-06	0.125	0.14	0.14	0.12	0.12	0.13	0.14	0.14	0.13	105.50	0.01	0.03	4.97
Dibromochloromethane	7-Feb-06	0.25	0.23	0.23	0.25	0.24	0.24	0.24	0.25	0.24	96.03	0.01	0.03	7.51
trans-1,2-Dichloroethylene	9-Feb-06	0.125	0.13	0.10	0.10	0.10	0.10	0.11	0.11	0.11	84.91	0.01	0.04	3.40
cis-1,2-Dichloroethylene	9-Feb-06	0.125	0.13	0.13	0.11	0.10	0.12	0.13	0.13	0.12	93.97	0.01	0.03	3.82
cis-1,3-Dichloropropene	9-Feb-06	0.125	0.15	0.12	0.10	0.10	0.11	0.13	0.12	0.12	92.55	0.02	0.05	2.41
m-Dichlorobenzene	7-Feb-06	0.25	0.15	0.13	0.14	0.14	0.12	0.13	0.14	0.14	54.62	0.01	0.03	8.05
o-Dichlorobenzene	7-Feb-06	0.25	0.15	0.15	0.16	0.13	0.14	0.14	0.14	0.14	57.88	0.01	0.03	8.67
p-Dichlorobenzene	7-Feb-06	0.25	0.15	0.15	0.14	0.12	0.12	0.13	0.13	0.13	53.52	0.01	0.03	7.45
trans-1,3-Dichloropropene	7-Feb-06	0.25	0.20	0.21	0.21	0.20	0.19	0.21	0.22	0.21	82.32	0.01	0.03	7.66
Ethanol	9-Feb-06	0.125	0.17	0.19	0.16	0.14	0.14	0.09	0.16	0.15	119.71	0.03	0.10	1.25
Ethylbenzene	9-Feb-06	0.125	0.15	0.13	0.11	0.10	0.11	0.13	0.12	0.12	97.20	0.02	0.05	2.63
Ethyl Acetate	9-Feb-06	0.125	0.15	0.15	0.13	0.13	0.14	0.15	0.15	0.14	113.25	0.01	0.04	3.21
4-Ethyltoluene	9-Feb-06	0.125	0.15	0.11	0.10	0.08	0.09	0.09	0.09	0.10	80.49	0.02	0.07	1.69

Detection limits derived using the method described in 40 CFR Part 136, Appendix B

Method: TO-15 (VTO14/15)  
Instrument(s): GCMSJ, GCMSQ  
Analyst: Pooled

Matrix: AIR  
Quant Factor: 1.00  
Study Period: February, 2006

Cmpd./Element/Parm. Name	Analysis Date	Spike ppbv	Replicate Spikes							X-Bar ppbv	X-Bar %Recov.	STD.Dev. ppbv	MDL ppbv	Spike/MDL Ratio	
			R1 ppbv	R2 ppbv	R3 ppbv	R4 ppbv	R5 ppbv	R6 ppbv	R7 ppbv						
Freon 113	7-Feb-06	0.25	0.21	0.19	0.21	0.19	0.20	0.19	0.20	0.20	79.73		0.01	0.03	7.78
Freon 114	9-Feb-06	0.125	0.14	0.14	0.13	0.12	0.13	0.14	0.14	0.13	105.68		0.01	0.03	4.33
Heptane	7-Feb-06	0.25	0.29	0.26	0.28	0.27	0.26	0.28	0.28	0.27	109.79		0.01	0.03	7.16
Hexachlorobutadiene	9-Feb-06	0.125	0.11	0.08	0.06	0.05	0.06	0.06	0.07	0.07	56.18		0.02	0.06	2.18
Hexane	7-Feb-06	0.25	0.26	0.24	0.28	0.25	0.26	0.26	0.27	0.26	103.96		0.01	0.04	5.96
2-Hexanone	9-Feb-06	0.125	0.11	0.09	0.08	0.08	0.08	0.09	0.09	0.09	70.51		0.01	0.03	3.71
Isopropylbenzene	7-Feb-06	0.25	0.23	0.23	0.25	0.23	0.23	0.23	0.24	0.23	93.59		0.01	0.03	8.16
Isopropyl Alcohol	9-Feb-06	0.125	0.22	0.21	0.18	0.18	0.19	0.19	0.22	0.20	158.13		0.02	0.05	2.45
Methylene chloride	7-Feb-06	0.25	0.42	0.38	0.41	0.38	0.41	0.39	0.40	0.40	158.95		0.01	0.04	5.75
Methyl ethyl ketone	9-Feb-06	0.125	0.15	0.15	0.13	0.12	0.13	0.14	0.15	0.14	111.95		0.01	0.04	3.32
Methyl Isobutyl Ketone	9-Feb-06	0.125	0.13	0.11	0.10	0.10	0.11	0.11	0.12	0.11	88.03		0.01	0.03	3.83
Methyl Tert Butyl Ether	7-Feb-06	0.25	0.26	0.27	0.27	0.28	0.26	0.27	0.29	0.27	107.93		0.01	0.03	7.76
Nonane	7-Feb-06	0.25	0.25	0.26	0.28	0.27	0.26	0.27	0.27	0.27	106.17		0.01	0.03	8.22
Pentane	9-Feb-06	0.125	0.15	0.14	0.14	0.12	0.13	0.15	0.14	0.14	111.89		0.01	0.04	3.46
Propylene	9-Feb-06	0.125	0.16	0.17	0.16	0.15	0.16	0.15	0.14	0.16	125.35		0.01	0.03	4.18
Styrene	7-Feb-06	0.25	0.20	0.19	0.21	0.19	0.18	0.18	0.20	0.19	77.55		0.01	0.03	8.95
1,1,1-Trichloroethane	7-Feb-06	0.25	0.22	0.23	0.25	0.23	0.24	0.23	0.24	0.23	93.87		0.01	0.03	8.34
1,1,2,2-Tetrachloroethane	7-Feb-06	0.25	0.24	0.22	0.24	0.23	0.23	0.24	0.26	0.24	95.23		0.01	0.04	5.93
1,1,2-Trichloroethane	7-Feb-06	0.25	0.22	0.23	0.25	0.24	0.24	0.25	0.25	0.24	96.11		0.01	0.04	7.06
1,2,4-Trichlorobenzene	7-Feb-06	0.25	0.15	0.09	0.08	0.06	0.05	0.06	0.06	0.08	31.81		0.03	0.11	2.29
1,2,4-Trimethylbenzene	7-Feb-06	0.25	0.20	0.19	0.21	0.20	0.19	0.20	0.19	0.20	79.18		0.01	0.03	9.74
1,3,5-Trimethylbenzene	7-Feb-06	0.25	0.22	0.21	0.23	0.23	0.22	0.21	0.23	0.22	89.39		0.01	0.03	8.87
2,2,4-Trimethylpentane	7-Feb-06	0.25	0.22	0.22	0.25	0.23	0.23	0.22	0.23	0.23	91.12		0.01	0.03	9.48
Tertiary Butyl Alcohol	9-Feb-06	0.125	0.15	0.15	0.13	0.12	0.14	0.15	0.15	0.14	112.82		0.01	0.05	2.76
Tetrachloroethylene	7-Feb-06	0.25	0.20	0.21	0.23	0.20	0.20	0.19	0.20	0.21	82.58		0.01	0.04	6.58
Tetrahydrofuran	7-Feb-06	0.25	0.26	0.26	0.29	0.27	0.26	0.27	0.27	0.27	107.26		0.01	0.03	7.62
Toluene	9-Feb-06	0.125	0.28	0.27	0.25	0.24	0.26	0.27	0.27	0.26	210.83		0.01	0.04	3.05
Trichloroethylene	7-Feb-06	0.25	0.26	0.24	0.27	0.25	0.24	0.25	0.26	0.25	100.75		0.01	0.04	6.81
Trichlorofluoromethane	9-Feb-06	0.125	0.14	0.14	0.13	0.12	0.14	0.15	0.15	0.14	108.53		0.01	0.03	4.28
Vinyl chloride	9-Feb-06	0.125	0.13	0.13	0.13	0.11	0.11	0.12	0.12	0.12	98.33		0.01	0.03	3.83
Vinyl Acetate	7-Feb-06	0.25	0.30	0.27	0.30	0.27	0.29	0.29	0.29	0.29	114.79		0.01	0.04	6.94
m,p-Xylene	7-Feb-06	0.5	0.48	0.46	0.50	0.48	0.46	0.48	0.45	0.47	94.19		0.02	0.05	9.21
o-Xylene	9-Feb-06	0.125	0.15	0.13	0.09	0.09	0.10	0.13	0.11	0.11	90.89		0.02	0.07	1.81



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